

INSTRUCTION MANUAL

Serial Number _____

603/604

MONITOR

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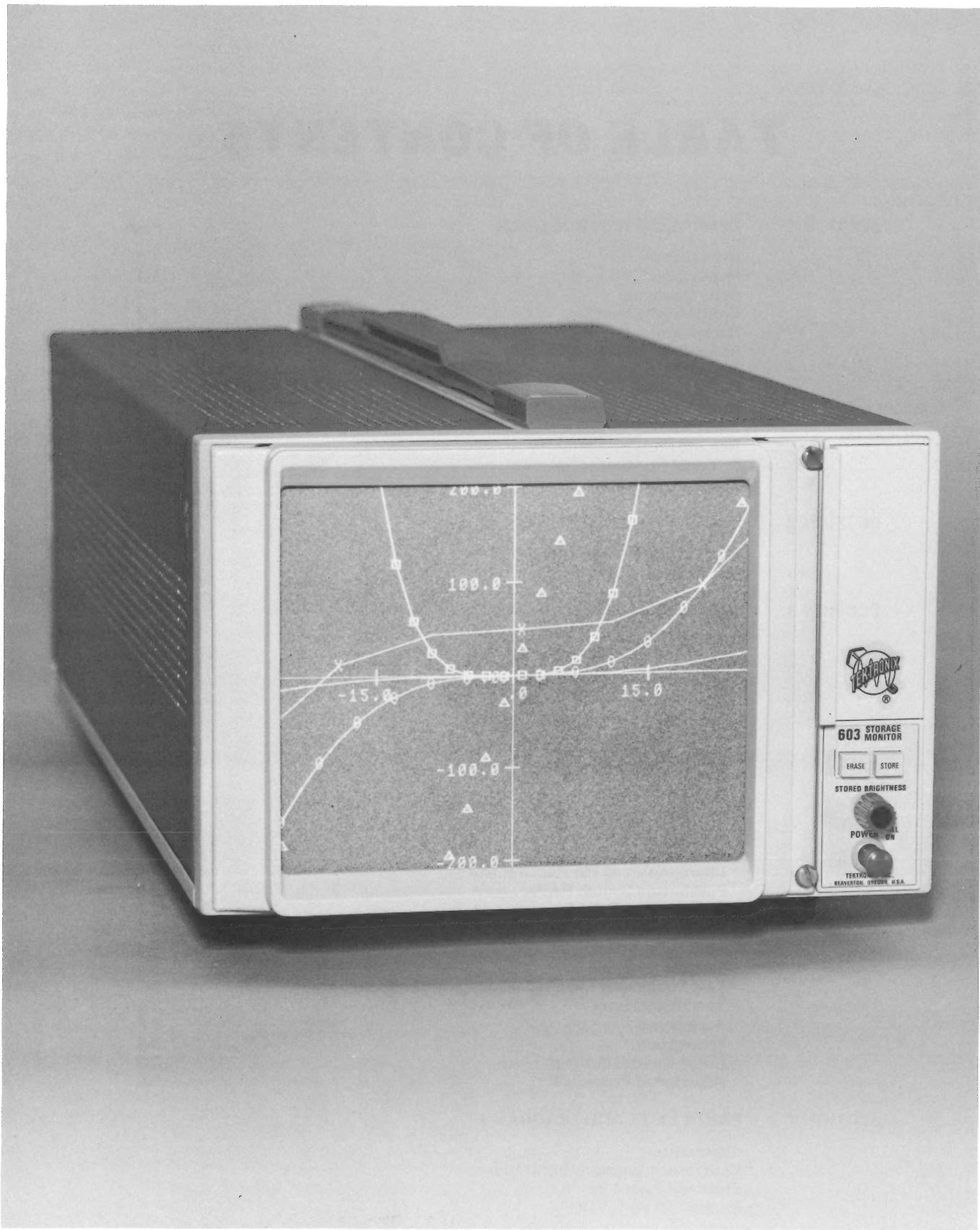
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603 Storage Monitor with a graph display.

SECTION 1

OPERATING INSTRUCTIONS

Introduction

The 603 Storage Monitor and 604 Monitor (non-storage) are general-purpose X-Y display monitors. Each provides a bright display of analog data in a large screen (6 1/2 inches) area. Resolution is excellent for most monitor uses, including alpha-numeric applications. The 603 and 604 are well suited for many display applications in ultrasonic detection systems, electron microscope systems, radiation and thermal scanning systems, speech therapy, mechanical pressure, volume, and vibration analysis, and medical and biophysical systems. The 603 is also well suited to provide stored displays of alpha-numeric and graphic information from computers and other data-transmission systems.

All display axes (vertical, horizontal and intensity) can be operated differentially as well as from a single-signal source. A remote-program connector permits the Monitor to be operated from a remote station. The 603 storage tube (CRT) allows a display to be held for up to an hour at normal stored brightness, and up to ten hours at low brightness. Both monitors can be operated from either a 120-volt or a 220-volt nominal line-voltage source.

Preparation

CAUTION

This instrument is designed for operation from a power source with its neutral at or near earth (ground) potential with a separate safety-earth conductor. It is not intended for operation from two phases of a multi-phase system, or across the legs of a single-phase, three-wire system.

1. Connect the Monitor power cord to a suitable power source. The Monitor is factory prepared for operation from a 120-volt nominal line and will operate properly if the power source is between 108 VAC and 132 VAC. If the source voltage is below this range (down to 90 VAC), or if the Monitor is to be operated from a 220-volt nominal line, refer to the Power Connection information and instructions later in this section.

CAUTION

Application of a high-amplitude Z-axis signal (up to 100 volts) will increase the CRT beam current and may damage the screen phosphor.

2. Apply the vertical signal to the Y INPUT and horizontal signal to the X INPUT. Apply the beam turn-on signal to the Z INPUT. All input connections are made at the rear of the monitor. Input signal requirements and remote-program connector information are given later in this section.

3. Open the access door on the front panel and check that the INTENSITY control is turned fully counterclockwise. Set the STORE button (603 only) to non-store (button out).

Basic Operation

1. Slowly increase the INTENSITY until the spot is visible.

2. Position the spot to the desired starting location. The Position controls are located behind the access door, and arrows on the panel adjacent to the knobs indicate the positioning direction.

3. Activate the vertical, horizontal, and z-axis signals and check for proper display. If the vertical or horizontal deflection seems excessive, those input signals can be attenuated by a 5:1 ratio; see Input Attenuator information later in this section. Adjust the FOCUS control for a sharp, well-defined display.

4. To check storage operation of the 603, push in the STORE button. Press the ERASE button to remove the accumulated charge from the storage screen. A background glow should be present on the screen. Activate the input signals and check for proper storage. If the INTENSITY control is set too low, the information will not store, or will only partially store. Optimum setting of the INTENSITY control is reached when the information stores uniformly. De-activate the input signals and check that the brightness of the stored display can be controlled by the STORED BRIGHTNESS control. Press the ERASE button to remove the stored display. Maximum viewing time of a stored display at full brightness is one hour; at low brightness, it can be held for up to ten hours.

5. To check operation of the optional time-base sweep, the internal XY-YT switch must be set to YT. This switch is located on the Deflection Amplifier board at the left rear of the instrument (refer to board picture on pullout pages).

Operating Instructions—603/604

Remove the left side panel to gain access. Activate the vertical signal. Set the SWEEP Seconds/Division switch to the desired sweep rate. This switch also determines the slope of the vertical signal at which the sweep is triggered. Set the TRIG LEVEL control for a stable display.

Front-Panel Controls

This is a brief description of the function or operation of the front-panel controls.

POWER Used to turn instrument power on or off.

STORE (603 only) Button pushed in selects storage operation of the CRT. Button out selects normal operation without storage. This button must be in to enable remote control of storage operation.

ERASE (603 only) Momentary-contact pushbutton initiates erasure of display information stored on the screen.

STORED BRIGHTNESS (603 only) Control varies the intensity of stored information; permits extended retention of stored information. For control to function, the CRT beam must be cut off. Also see Remote Program connector data remote view-hold mode.

INTENSITY Controls display brightness.

FOCUS Provides adjustment to obtain a sharp display.

Position Two controls position the writing beam or display. Arrows indicate axis controlled.

SWEEP (Optional)
Seconds/Division and Slope Time per major graticule division (8 X 10 scribed graticule optional). Selects one of six calibrated sweep rates between 0.1 s/div and 1 μ s/div in decade steps. This switch also selects the slope of the displayed signal at which the sweep is triggered.

VARIABLE

Screwdriver adjustment concentric with Seconds/Division and Slope switch provides uncalibrated, continuously variable sweep rate between calibrated steps. It extends the sweep rate range to 1 second/division.

TRIG LEVEL

Screwdriver adjustment selects the level of the triggering signal at which the sweep is triggered.

Rackmounting

The 603/604 Monitor can be operated in a standard 19-inch instrument rack. Vertical rack space required is 5 1/4 inches. Conversion kits are available to mount two monitors side by side, or to mount a single monitor. Contact your local Tektronix Field Office or representative.

Power Connection

The 603/604 can be operated from either a 120-volt or a 220-volt nominal line-voltage source. The power transformer is wired to permit one of six regulating ranges to be selected. The range for which the primary taps are set is marked on the rear panel of the instrument. Use the following procedure to obtain correct instrument operation from the line voltage available.

1. Disconnect the instrument from the power source.

2. Remove the right side panel of the instrument to gain access to the power rectifier circuit board. A picture of this board showing the transformer primary taps is provided on a pullout page at the rear of the manual.

3. To convert from 120 volts to 220 volts nominal line voltage, or vice versa, remove the line-selector block from the primary tap square-pin connectors and replace it with the other block. Remove the line fuse from the fuse holder located on the rear panel and replace it with one having the correct rating. The unused line-selector block can be stored on the Rectifier circuit board. Change the line cord power plug to match the power source receptacle, or use an adapter.

NOTE

The 120-volt block is color coded brown, and it connects the transformer primary windings in parallel. The 220-volt block is color coded red, and it connects the primary windings in series.

4. To change regulating ranges, place the line-selector block on the desired set of square pins. Select a range which is centered about the average line voltage to which the instrument is to be connected (see Table 1-1).

5. Change the nominal line voltage information on the rear panel of the instrument. Use a non-abrasive eraser to remove the previous data, and mark in new data with a pencil.

6. Replace the side panel and apply power to the instrument.

CAUTION

Damage to the instrument may result from incorrect placement of the line-selector block.

TABLE 1-1
Regulating Ranges

Line selector block position	Regulating Range	
	120 Volts Nominal	220 Volts Nominal
L	90 VAC to 110 VAC	180 VAC to 220 VAC
M	99 VAC to 121 VAC	198 VAC to 242 VAC
H	108 VAC to 132 VAC	216 VAC to 264 VAC

Ambient (Surrounding) Temperature Considerations

The 603/604 can be operated where the ambient air temperature is between 0°C and +50°C (between +32°F and +122°F). The instrument can be stored in ambient temperature between -40°C and +70°C (between -40°F and +158°F). After storage at a temperature beyond the operating limits, allow the chassis temperature to come within the operating limits before power is applied.

Signal Connectors

BNC connectors are provided at the rear of the instrument for application of input signal (either single-ended or differential) to the Y and X deflection amplifiers and to the Z-axis amplifier to control beam intensity. As shipped, the instrument is prepared for single-ended inputs; grounding caps are connected to the - inputs. For differential operation, the grounding cap is removed and a signal is applied to both connectors. Also, the connectors can be internally disconnected from ground, permitting a "floating" input. See Electrical Characteristics later in this section for differential capability data.

Input Requirements

The vertical and horizontal deflection factors are set by the factory to a nominal 1 volt for full scale deflection on each axis. Thus the input requirements are 0.125 volt for each division (one-half inch) of vertical deflection, and 0.1 volt for each division of horizontal deflection. An internal gain control for each deflection amplifier permits an adjustable full-scale range from 0.5 volt or less to 2.5 volts or more, and an internally selectable 5:1 attenuator extends the deflection factor range to 12.5 volts or more for full scale deflection. In any case, do not apply a signal with amplitudes exceeding 100 volts to the Y or X inputs.

With no signals applied to the Z INPUT connectors, the intensity of the display is controlled by the front-panel INTENSITY control. The intensity range provided by this control is from no visual intensity (CRT beam off) to full bright. To control the intensity with an externally applied signal, set the INTENSITY control to about midrange. An internal gain control permits the Z input requirement for full intensity control to be adjustable from +1 volt or less to +5 volts or more, depending on the exact setting of the INTENSITY control. A zero-volt input cuts off visual intensity when the INTENSITY control is at about midrange. Exercise care in establishing the correct display intensity; a too-high amplitude Z input signal combined with a too-high INTENSITY control setting may increase the beam current above the phosphor-damaging level. In any case, do not apply a Z input signal with amplitudes exceeding 100 volts.

Input Attenuators

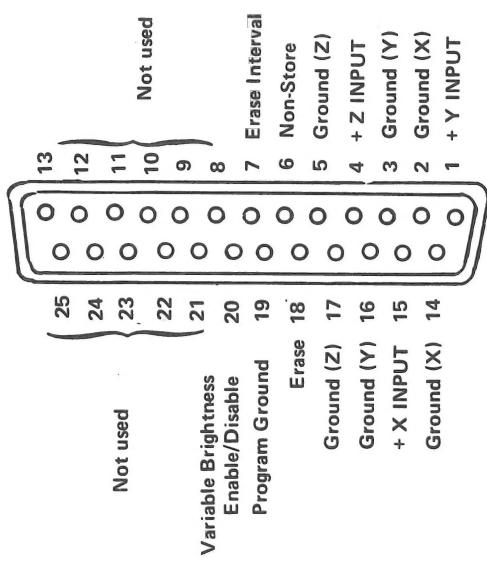
Each Y and X input circuit includes a selectable 1:1 - 5:1 attenuator, which is set for 1:1 operation when shipped from the factory. The switches for selecting 5:1 attenuation are located on the Deflection Amplifier circuit board at the left rear of the instrument. Remove the left side panel to gain access. Refer to the board picture given on a pullout page at the rear of this manual.

Remote Program Connector

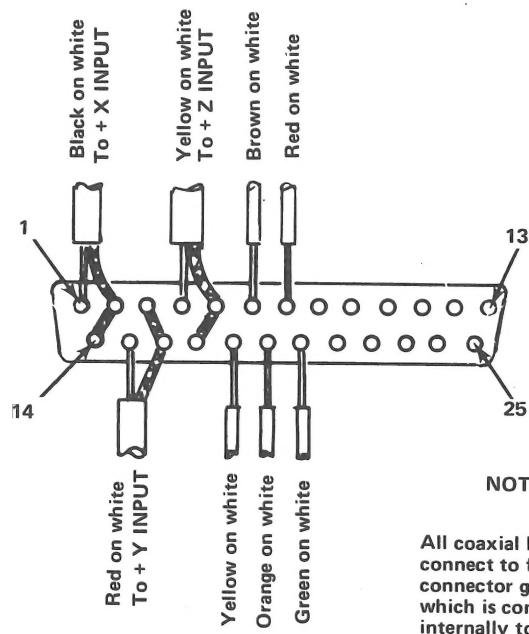
The Remote Program connector, located on the rear panel, provides direct connections to the + inputs of the X, Y, and Z amplifiers from a remote location. Also, storage operation of the 603 can be controlled from a remote location; however, the front-panel controls of the instrument override the remote inputs. All inputs and outputs are TTL compatible. See Fig. 1-1 for details.

Remote Erase. Stored display will be erased when a remote contact is closed to ground, or logical 0 (TTL) is applied.

Remote Non-Store. Closing the remote contact to ground or applying a logical 0 (TTL) allows the storage CRT to operate in the non-store mode.



As seen from the rear panel.



NOTE

All coaxial braids connect to floating connector ground, which is connected internally to chassis ground.

The switching requirements (voltage levels, loading, drive, etc.) of remote-controlled functions can be satisfied by a TTL circuit.

TTL-Compatible Logic Levels:

	VOLTS	CURRENT
Logical 1 =	+2 V +5 V	@1 mA @0 mA
Logical 0 =	0 V +0.8 V	0 mA 10 mA

Fig. 1-1. Remote Program Connector data.

Erase Interval. During the erase interval, a negative-going pulse, logical 0 (TTL), is present at this contact. This can be used to notify associated equipment that information stored on the 603 screen is being erased.

Variable Brightness Enable/Disable. This input line permits switching stored brightness from full bright to the level established by the STORED BRIGHTNESS control when a remote contact is closed to ground or when a logical 0 (TTL) is applied.

Application of a logical 1 (TTL) enables the STORED BRIGHTNESS control, even though the CRT beam is at writing intensity. This mode is useful only when the spot is stationary.

Optional Instrument Features

603. The 603 can be ordered with an internal sweep-generating circuit to provide an oscilloscope-type time base. Six calibrated sweep rates from 0.1 second/division through

1 microsecond/division in decade steps are selectable by a front-panel knob. An internal black graticule scribed with eight vertical and ten horizontal divisions (each division is one half inch square) is available as an option; a blank CRT faceplate is standard for the Storage Monitor. Also, a storage tube capable of a 200-division writing rate is available.

Option 1—internal non-illuminated graticule 8 X 10 div.

Option 2—fast writing rate CRT (>200 div/ms).

Option 3—instrument without handle and feet.

Any combination of options can be ordered. Example: fast CRT with graticule, order option 1 and 2.

604. The internal sweep-generating option described in the preceding paragraph is available for the 604. The 604 can be ordered with no graticule instead of the standard 8 X 10 division internal black graticule. Also, optional P4 and P7 phosphors are offered for the 604 (P31 is standard).

Option 1—without graticule.

Option 2—instrument without handle and feet.

A 603 or 604 ordered without graticule will receive an external graticule as an accessory to aid in calibration.

ELECTRICAL CHARACTERISTICS

Vertical and Horizontal Amplifiers

Deflection Factor. Vertical: nominally set for 1 V full scale; internally adjustable from 0.5 V or less to 2.5 V or more full screen (range of at least 62.5 mV/div to 325 mV/div). Horizontal: nominally set for 1 V full scale; internally adjustable from 0.5 V or less to 2.5 V or more full screen (range of at least 50 mV/div to 250 mV/div). An internal 5:1 attenuator extends the deflection factor range to 12.5 V or more full screen for both axes.

Polarity (Differential Inputs). Positive signal applied to + input deflects beam up or to the right; negative signal deflects beam down or to the left. Positive signal applied to — input deflects beam down or to the left; negative signal deflects beam up or to the right.

Bandwidth and Response. Spot must reach new writing position within 1 μ s from any on-screen position. Based on 80% full-screen reference signal, the amplifier bandwidth is 2 MHz; risetime is 0.18 μ s or less.

Differential Capability. 3 V non-attenuated common mode dynamic range; at least 100:1 CMRR to 100 kHz without attenuator. 15 V common-mode dynamic range with 5X attenuator; at least 50:1 CMRR to 100 kHz with 5X attenuator.

Phase Difference. Within 1° between equal-gain X and Y to 500 kHz.

Position Stability. 0.1 division or less (0.050 inch or less) per hour after 20-minute warmup.

Input R and C. 1 M Ω paralleled by less than 47 pF.

Maximum Input Voltage. ± 100 V (DC + peak AC).

Position Range. About ± 12 divisions from screen center; allows setting zero signal position anywhere on screen.

Z Axis Amplifier

Useful Input Voltage. Adjustable from +1 V or less to +5 V or more for full intensity control when the INTENSITY control is set to about midrange. Under this condition, zero-volt input cuts off visual intensity.

Useful Frequency Range. DC to 5 MHz (at -3 dB), 70 ns risetime.

Differential Capability. 5 V common mode; at least 100:1 CMRR to 100 kHz.

Input R and C. 1 M Ω paralleled by less than 47 pF (differential inputs).

Maximum Safe Input. ± 100 V (DC + peak AC) when INTENSITY control is fully counterclockwise. See Caution under Basic Operation.

CRT Display

CRT. 6 1/2-inch flat faceplate, electrostatic deflection. Phosphor is similar to P1 for the 603; P31 is standard for the 604. Optional for the 604 are P4 and P7.

Display Quality Area. 8 X 10 divisions (4 X 5 inches).

Display Linearity (Vertical and Horizontal). No more than 5% difference between any two divisions.

Maximum Spot Size. 25 mils.

Geometry. 0.1 division (0.050 inch) or less.

Resolution (Non-Store). 128 line pairs vertically; 160 line pairs horizontally.

Storage Display (603 Only). Stored resolution is 80 line pairs vertically, 100 line pairs horizontally. Writing speed is at least 20 divisions/millisecond (at least 200 divisions/millisecond with optional fast-writing CRT). Storage time is 1 hour at full stored brightness; erase time is about 250 milliseconds.

SECTION 2

THEORY OF OPERATION

Introduction

This section of the manual contains an electrical description of the circuits in the 603 and 604 display monitors. An overall block diagram of these units and complete schematics are given on pullout pages at the rear of this manual.

BLOCK DIAGRAM DESCRIPTION

The Deflection Amplifiers process input signals and provide push-pull outputs suitable to drive the vertical (Y) and horizontal (X) deflection plates. Input signals can be applied either single ended or differentially.

The Z-Axis Amplifier controls the beam intensity by providing a voltage to drive the CRT control grid. Input signals can be applied either single ended or differentially.

The CRT Circuit produces the high voltage (about -3450 volts) and contains the controls necessary for operation of the cathode-ray tube.

The Storage Circuit provides the voltage levels necessary to operate the storage elements associated with the CRT in the 603. The circuit includes the erase-pulse generator for erasing stored information and a multivibrator which permits the flood-gun duty cycle to be varied.

The Power Supply circuit provides the low-voltage operating power for the 603 and 604 monitors. Electronic regulation is used to provide stable, low-ripple output voltages.

CIRCUIT DESCRIPTION

Deflection Amplifiers

General. The Deflection Amplifiers process input signals and provide push-pull outputs suitable to drive the deflection plates. Input signals can be applied either single ended or differentially. Negative feedback is employed to insure a highly-stabilized output.

NOTE

The following description applies to both the vertical and horizontal (Y and X) amplifiers; however, the circuit numbers used are those of the vertical (Y) circuit.

Inputs. Signals can be applied to either J110 (+) or J130 (-) as single-ended inputs, or to both connectors as a differential input. Also, a signal may be applied via the Remote Program connector to the + input. An internal switch for each input (S110, S130) allows a choice of either 1:1 or 5:1 attenuation of the input signal before it is applied to the input FET gate. The input 5X attenuators are frequency-compensated voltage dividers.

Preamplifier. The preamplifier stage employs field-effect transistors to provide a high input impedance. This stage consists of two identical feedback amplifiers, Q120A-Q152 and Q120B-Q156, which can be operated as either a paraphase amplifier (with a single-ended input) or as a differential amplifier. A push-pull signal is produced at the collectors of Q152 and Q156. The FET gates are diode-clamped on negative-going overdrive signals, protecting the transistors in the amplifier. R125, Y Gain, provides an adjustable amplification factor to allow a CRT full-scale deflection range from 0.5 volt or less to 2.5 volts or more. This control is set by the factory to a nominal 1 volt for full-scale deflection on each axis.

Output Amplifier. The output amplifier stage consists of two identical non-inverting operational amplifiers connected in a differential configuration. Q172 and Q192 provide constant current for input emitter followers Q162 and Q182. Q162 and Q182 receive the push-pull signal from the preamplifier stage, and the input signal is developed across the resistance between their emitters. The signal current is forced through R165 and R185, producing the deflection-plate drive signal at the collectors of Q222 and Q226. Q202 and Q208, whose bases are diode-protected to ensure quick overdrive recovery, provide the drive for the output transistors. The Q222-Q226 collectors are diode-clamped on negative-going overdrive signals.

Display positioning is accomplished by adjustment of R175 (vertical) and R375 (horizontal). These resistors provide a shift in the constant-current source transistors, shifting the quiescent output voltage. Capacitors C168 and C368 are adjustable to provide frequency compensation.

Z-Axis Amplifier

General. The Z-Axis Amplifier controls the CRT beam intensity by providing a voltage to drive the CRT control grid. Input signals can be applied either single ended or differentially.

Inputs. Signals can be applied to either J505 (+) or J515 (-) as single-ended inputs, or to both connectors as a differential input. Also, a signal may be applied via Remote Program connector J200 to the + input. A provision is made on each input line to permit installation of attenuating resistors.

Preamplifier. The Z-axis preamplifier stage employs field-effect transistors to provide a high input impedance. This stage consists of two identical feedback amplifiers, Q520A-Q526-Q534 and Q520B-Q528-Q536, which can be operated as either a paraphase amplifier (with a single-ended input) or as a differential amplifier. A single-ended output is produced at the collector of Q534, and is opposite in polarity to a signal applied to the + input and in phase with a signal applied to the - input. Constant current for the stage is supplied by Q532. The FET gates are diode-clamped on negative-going overdrive signals, protecting the transistors in the preamplifier. R512, Z Gain, provides an adjustable amplification factor to allow a full intensity control range of from +1 volt or less or +5 volts or more to be established when the INTENSITY control in the output stage is set to about midrange. Under this condition, a zero-volt input cuts off visual intensity.

Output Amplifier. The output amplifier is a non-inverting operational amplifier consisting of Q542, Q544, Q554, and Q556. The feedback resistor is R556. Q554 and Q556 are connected as a collector-coupled complementary amplifier to provide a fast, linear output signal while consuming minimum quiescent power. The quiescent output level can be set by adjustment of the INTENSITY control, R562. The output is applied to the CRT control grid circuit.

CRT Circuit

General. The CRT circuit produces the high-voltage potential and provides the control circuits necessary for operation of the cathode-ray tube (CRT).

High-Voltage Oscillator. A class C oscillator consisting of Q580 and its associated circuitry provides the drive for the high-voltage transformer, T580. When the instrument is turned on, conduction of Q576 provides a base current path for Q580. The collector current of Q580 increases, producing an increased current in the Q580 base winding and causing increased conduction of Q580. Eventually the rate of collector current increase in Q580 becomes less than that required to maintain the voltage across the collector winding, and the voltage drops as the field collapses. This turns off Q580 by way of feedback voltage to the base. Q580 remains off until the feedback voltage on the base is near the peak positive value again. The cycle repeats at a frequency of 40 to 50 kilohertz. The amplitude of sustained oscillation depends upon the average current delivered to the base of Q580, and finally, the average Q580 collector current.

High Voltage Regulation. Regulation is accomplished as follows: Feedback from the -3450-volt cathode supply is summed with a low-voltage level through the voltage divider consisting of resistors R573A, R573B, and R575 to establish the DC level at the base of Darlington transistor Q570. This sample of the output voltage is compared to the regulated +15 volts in the base circuit of Q570. Any changes in the high-voltage output are sensed by Q570, which produces an error signal to control the conduction of Q576. Q576 correspondingly produces a change in the average Q580 base current, nullifying the change in the high-voltage output and thus holding it constant. The DC level at the base of Q570 is adjusted by R575, High Voltage, to set the high-voltage output to exactly -3450 volts.

Electron Gun Cathode and Grid Supplies. Half-wave rectifier CR580 produces -3450 volts DC, which is filtered and applied to the CRT cathode as the accelerating potential. The cathode heater is elevated to the cathode potential through R590.

Bias voltage for the grid is supplied by a DC restorer network consisting of CR566, CR567, and R565. The DC restorer has the -3450-volt cathode potential applied to it as a reference voltage, and it is driven by a varying voltage obtained from a tap on the secondary winding of T580. R588, Cutoff, provides a fine adjustment of the quiescent grid voltage to bias the electron gun just below cutoff when the Z-Axis Amplifier output is at its minimum quiescent level (INTENSITY control counterclockwise and no signals applied). A change in the Z-Axis Amplifier output produces an almost equal change of voltage on the control grid, allowing the Z-Axis Amplifier to control the CRT beam current.

CRT Control Circuits. In addition to the INTENSITY control discussed in the Z-Axis Amplifier circuit, front-panel FOCUS and internal astigmatism controls have been incorporated for arriving at an optimum CRT display. FOCUS control R595 provides the correct voltage for the second anode of the CRT. Proper voltage for the third anode is obtained by adjusting Astig control R594. In order to obtain optimum spot size and shape, both the FOCUS and Astig controls are adjusted to provide the proper electrostatic lens configuration in the CRT.

The Geom adjustment R596 varies the positive level on the horizontal deflection plate shields to control the overall geometry of the display. The TRACE ROTATION control, R598, permits adjustment of the DC current through beam-rotation coil L598 to align the display.

Storage Circuit (603 Only)

General. The CRT used in the 603 is a direct-view bistable storage cathode-ray tube. Only those elements associated with the storage capability of the CRT are shown in the CRT symbol on the right side of the Storage Circuit diagram. The writing gun, its deflection systems and associated elements will be discussed under CRT Circuit.

Storage Operation. Four low-energy electron guns (flood guns) provide full coverage of the large screen area. The cathode heaters, which receive an unfiltered pulsating DC from full-wave rectifier CR775, are elevated to the cathode potential through R775. Quiescently Q615 is saturated, providing current to the flood-gun cathodes. The anode potential is established by VR734 and supplied via emitter follower Q735.

The collimation electrode is a metallic band around the inner wall of the CRT envelope. It produces an electrostatic field to distribute the flood-gun electrons uniformly over the storage target. R730, CE1, provides adjustment of the flood electron trajectories to cover the extreme rim of the targets and optimize uniformity of the target coverage. Emitter follower Q725 maintains a stable voltage on the collimation electrode, providing a low-impedance current path to absorb current variations.

The storage screen consists of a thin tin oxide layer called the target backplate, which is coated with an insulator material containing finely-ground phosphor particles called the target. A positive voltage potential is applied via Q680 to backplate to establish the operating level of the tube, which is the difference in potential between the backplate and the flood-gun cathodes.

The target operates in a bistable mode because of the secondary emission properties of the insulator material. The first stable state is the rest potential, at which the target has gathered low-energy flood-gun electrons, causing it to charge down to the flood-gun cathode potential. The second stable state is stored state, at which the target (or portions of it) is shifted to the backplate potential by increasing the secondary emission. While the flood guns do not have sufficient energy to shift the target to the stored state, they do supply sufficient energy to hold the target in the stored state after it has been shifted by the high-energy writing-gun beam (CRT beam). This is because the landing energy of the flood electrons has increased with the increased potential difference between the flood-gun cathode and the target. These higher energy electrons produce a visual display as long as the flood beam covers the target.

When the stored display is no longer needed, the information is erased by first shifting the entire target to the stored state, and then removing the charge. A positive-going short-duration pulse is first applied to the backplate, increasing the flood-gun electron landing energy and writing the entire target area. Next, the backplate voltage is pulled well below the rest potential of the target, which follows due to its inherent capacitive coupling. Then, as the backplate is gradually returned to its quiescent potential, the target charges to the rest potential and is ready to write again.

Backplate Supply. A regulated +360-volt DC power supply provides the storage level for the CRT and ensures a potential sufficient for the erasure process. Full-wave bridge rectifier CR820 through CR823 in the Power Supply circuit furnishes the required voltage. The regulator consists of series-pass transistor Q762, emitter follower Q760, and error amplifier Q764. The +360-volt output is compared to the -30-volt reference at the base of Q764, which supplies correction bias to Q762. Operation of this feedback amplifier system is similar to that described for the -30-volt supply (Power Supply circuit). VR763 is a protection device for the transistors, and is normally operated in a region of its characteristic curve below its Zener knee.

Backplate Control Amplifier. A high degree of control of the target backplate is maintained by a feedback amplifier system consisting of Q675, Q678, and Q680. The operational amplifier summing point is at the base of Q675, and the feedback resistor is R672. Variable resistor R670, Store Level, provides an adjustment of the current to the null point, and hence sets the backplate voltage through R672 to an optimum storage level.

Theory of Operation—603/604

Sensitivity Correction. When the 603 is operated in the store mode, the divider network in the high-voltage regulator circuit is modified to shift the high voltage slightly, correcting for the deflection sensitivity changes that occur. The backplate voltage is applied through R716 to the base of Q715, removing the ground potential from the Q715 collector. R715 permits an adjustable sensitivity correction to be applied to the high-voltage regulator.

Erase Generator. The previously discussed backplate control operational amplifier is driven by a monostable multivibrator when it is desired to erase a stored display. The multivibrator consists of Q640, which is normally on, and Q644, which is normally off. Q648 is part of the erase interval circuit and will be discussed later. All inputs of U630B are held high (+5 volts), keeping output pin 8 low. The multivibrator is switched either by pushing the front-panel ERASE button or by remote application of a TTL-compatible low level (see Fig. 1-2). When any of the U630B input lines are pulled low, pin 8 snaps positive. The positive transition is coupled through C636 and CR636 to the base of Q644, causing the multivibrator to switch states. The negative-going step produced at the Q644 collector causes a corresponding positive-going step at the output of the operational amplifier. This positive-going step is applied to the target backplate, increasing the storage level and "writing" the entire target.

After an RC-controlled time of 10 milliseconds, the multivibrator reverts to its quiescent state, producing a positive-going step at the collector of Q644 as the transistor turns off. This positive-going step is coupled through C644, and the backplate is pulled negative through the action of the operational amplifier. The target is pulled well below its rest potential. As C644 charges, the voltage at the cathode of CR664 decays from about +15 volts toward the -30 volt supply at an RC-controlled rate until it is clamped at ground by conduction of CR664. This action allows the target backplate to be raised slowly to its operating level, while the target remains at the flood-gun cathode potential. The total time from initiation of erasure to the ready-to-write condition is about 250 milliseconds.

Flood-Gun Cathode Control. As previously mentioned, Q615 provides the current for the flood-gun cathodes. It operates at saturation, establishing a cathode potential of nearly -30 volts. Q615 is controlled by two circuits: collector-coupled multivibrator Q620-Q628 and transistor switch Q610. When either Q628 or Q610 is on, Q615 is conducting flood-gun current.

Symmetry of the multivibrator is controlled by R622 and R625. R625, STORED BRIGHTNESS, is adjustable to allow Q615 to conduct anywhere from 10% to 100% (Q610 must be off to enable multivibrator control), which has the effect of varying the stored brightness.

When Q610 is turned on, it provides a control to override the multivibrator output and hold Q615 in its conduction state. A positive level either from the output of the Z-axis circuit or from the Remote Program connector turns Q606 on, providing base current for Q610. Also, during the erase interval, CR608 provides base current for Q610. Q610 can be held off by application of a TTL-compatible low level to R602, enabling the stored brightness control.

Erase Interval. During erasure, a 250-millisecond negative pulse is made available to associated equipment via pin 7 of Remote Program Connector J200. Normally the output of U630A (pin 6) is held high by the low applied via CR652 to input pin 5. When the erase pulse is initiated, the 10-millisecond negative-going pulse at Q644 collector results in a corresponding positive-going pulse at Q648 collector. This pulls pin 5 of U630A high, producing a low level at pin 6. C652 holds pin 5 for the total erase cycle.

Non-Store Mode. In the non-store mode, the target is held below the rest potential, allowing the CRT to operate in the manner of a conventional CRT. This feature prolongs the life of the storage tube. During storage operation, Q700 is held above cutoff and Q690 conducts. If S695 is set to the non-store mode (front-panel button out), or if a TTL-compatible low level is applied via pin 6 of J200, Q700 is biased into saturation. Its collector rises to essentially ground potential, cutting off Q690 and forcing current into the operational amplifier null point (Q675 base) to pull the backplate negative. The backplate non-store level can be set by adjustment of R700.

Power Supply

General. The Power Supply circuit provides the low-voltage operating power for the 603/604 Monitor. Electronic regulation is used to provide stable, low-ripple output voltages.

Power Input. Power is applied to the primary of transformer T800 through fuse F800, thermal cutout TK800, power switch S800, and line-selector block P810. The line-selector block allows changing the primary-winding taps of T800 to fit different line requirements.

Low-Voltage Rectifiers and Unregulated Outputs. The full-wave bridge rectifiers and associated filter components in the secondaries of T800 provide filtered DC voltages for operation of the 603/604 or for regulation by the Low-Voltage Regulators. The unregulated +20-volt output to the high-voltage transformer and the regulated +215-volt output are fuse protected. In the 603, a bridge rectifier is provided to supply power to the +360-volt regulator located in the Storage circuit.

Low-Voltage Regulators. The -30-volt supply, besides providing power to circuitry throughout the instrument, provides a reference-voltage source to establish operating levels for the feedback regulators in the +15-volt, +215-volt, and the 603 +360-volt supplies. The regulator for the -30-volt supply is a feedback amplifier system which operates between ground and the unregulated -38 volts. Current to the load is delivered by the series-pass transistor, Q860, and the supply voltage is established by the drop across R877, R878, and R879. The feedback path is through R875, Q875, and Q865 to the base of Q860. Any variation in output voltage due to ripple, change of current through the load, etc., is immediately transmitted to the base of Q860 and nullified by a change in Q860 conduction, thus maintaining a steady output. The output of the supply is set to exactly -30 volts by adjustment of R878, -30 V Adjust. This control sets the conduction of Q870, which controls the bias levels of Q865 and Q860. CR865 and Q865 provide short-circuit protection by limiting the current through Q860.

The regulator for the +15-volt supply consists of series-pass transistor Q840 and error amplifier Q852. This is a feedback amplifier system similar to that just described for the -30-volt supply. Q846 protects the supply in the event the output is shorted by limiting the current demanded from the series-pass transistor under excessive load. During normal operation, Q846 is biased off.

The regulator for the +215-volt supply consists of series-pass transistor Q836 and error amplifier Q830. Operation of this feedback amplifier system is similar to that described for the -30-volt supply.

CRT Heater Windings. Two separate secondary windings are provided for the CRT writing-gun heaters and the 603 flood-gun heaters. The writing-gun heaters are elevated to -3450 volts in the CRT circuit to maintain a potential near that of the CRT cathode.

SECTION 3

SERVICING AND ADJUSTMENTS

General

This section of the manual contains maintenance information and servicing instructions for the 603 and 604 display monitors. The adjustment procedure may also be used as a performance check for incoming inspection.

Panel Removal

WARNING

Disconnect the power before cleaning the unit or replacing parts.

The cabinet panels are held in place by slotted fasteners. To remove the panels, turn each fastener counterclockwise a quarter turn with a large screwdriver, coin, or similar device. Then the panels can be lifted away. The unit should be operated with its panels in place to protect the interior from dust, and to eliminate shock hazard.

Cleaning

Remove loose dust from the exterior with a soft cloth or a dry brush. A water and mild detergent solution may be used; however, avoid abrasive cleaners. For the interior, use low-velocity compressed air to blow off the accumulated dust.

CAUTION

Avoid the use of chemical cleaning agents which might damage plastic parts. Avoid chemicals which contain benzene, toluene, acetone, or similar solvents.

TROUBLESHOOTING

General

The following information is provided to aid in troubleshooting the display monitor. The schematic diagrams and circuit description should be used to augment this information.

Diagrams. Circuit diagrams are given on fold-out pages in the next section. The circuit number and electrical value of each component in this instrument are shown on the diagrams.

Circuit Board Pictures. Pictures of the circuit boards are provided in the fold-out pages to show the physical location of each component. The pictures are placed near their respective associated schematic diagrams to aid in cross reference between the diagrams and the component location. The circuit boards are identified by assembly numbers (A1, A2, etc.).

Component and Wiring Color Code. Colored stripes or dots on resistors and capacitors signify electrical values, tolerances, etc., according to the EIA standard color code. Components which are not color coded usually have the value printed on the body.

WARNING

This color code applies to leads within the 603/604 Monitor only. Color code of the AC power cord is

<i>Black</i>	<i>Line</i>
<i>White</i>	<i>Neutral</i>
<i>Green with a yellow stripe</i>	<i>Safety Earth (ground)</i>

Semiconductor Lead Configuration. Fig. 3-1 shows the lead configuration of the semiconductor devices used in this instrument.

Troubleshooting Equipment

The following equipment is useful for troubleshooting the 603 or 604:

1. Semiconductor tester, dynamic type, for testing the semiconductors used in this instrument. Recommended type: Tektronix 5CT1N Curve Tracer (operates with 5100-series oscilloscope listed below).

2. Multimeter, VTVM, 10-megohm input impedance and 0 to 300 volts range, AC and DC. Ohmmeter, 0 to 50 megohms; accuracy, within 3%. Test prods must be insulated to prevent accidental shorting. Multimeter is used to check voltages and for general troubleshooting in this instrument.

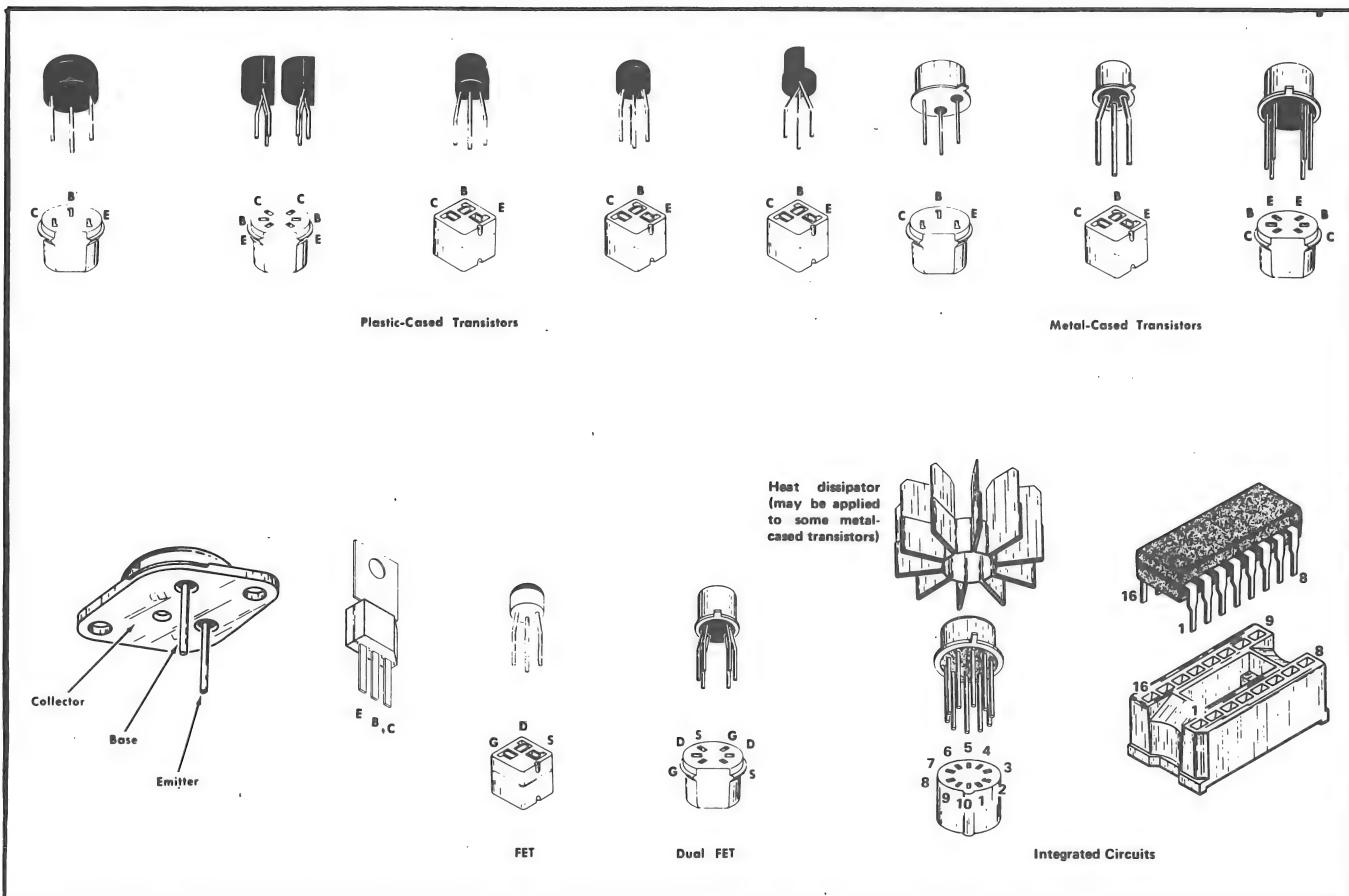


Fig. 3-1. Electrode configuration data for semiconductor devices.

NOTE

A 20,000 ohms/volt VOM can be used to check the voltages in this instrument if allowances are made for the circuit loading of the VOM at high-impedance points.

3. Test oscilloscope to check the active circuits in this instrument. Frequency response, DC to 2 megahertz minimum; deflection factor, 1 millivolt/division to 5 volts/division. Recommended type: Tektronix 5103N Oscilloscope. A 10X, 10-megohm voltage probe should be used to reduce circuit loading for voltage measurements.

Troubleshooting Guide

If the instrument is not providing the desired display or function, check control settings and associated equipment first. Be sure that all system interconnections are properly made and that each piece of equipment is operating properly.

Once it is determined that the 603/604 Monitor is defective, isolate the trouble to a circuit. Visually check the

suspected circuitry for damaged components, heat-charred circuit board, loose wires, etc. Take voltage and waveform readings to check the proper circuit operation. Turn the power off when making continuity checks. When checking individual components with an ohmmeter, unsolder one end of the component to isolate the measurement from the effects of surrounding circuitry.

Special techniques or procedures required to replace major components or assemblies in this unit are given under Component Replacement. Be sure to check the performance of any circuit that has been repaired or that has had any electrical components replaced, and if necessary, make the required adjustment.

REPLACEMENT PARTS

Standard Parts

All electrical and mechanical part replacements for the 603 or 604 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally from any electronics supply house. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

Special Parts

Some parts are manufactured or selected by Tektronix to satisfy particular requirements, or are manufactured for Tektronix to our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts

When ordering replacement parts from Tektronix, Inc., refer to the Parts Ordering Information and Special Notes and Symbols immediately preceding the electrical parts list. Include the following information:

1. Instrument Type (603 or 604)
2. Instrument Serial Number
3. A description of the part (if electrical, include the circuit number)
4. Tektronix Part Number

COMPONENT REPLACEMENT

General

The exploded-view drawing associated with the mechanical parts list (pull-out pages) may be helpful when disassembling or re-assembling individual components or sub-assemblies.

Circuit Board Replacement

To remove or replace a board, proceed as follows:

1. Disconnect all leads connected to the board (both soldered lead connections and solderless pin connections).
2. Remove all screws holding the board to the chassis or other mounting surface. Push the black plastic mounting clips away from the circuit board edges to free the board. Also, remove any knobs, etc., that would prevent the board from being lifted out of the instrument.
3. Lift the circuit board out of the unit. Do not force or bend the board.
4. To replace the board, reverse the order of removal. Use care when replacing pin connectors; if forced into place incorrectly positioned, the pin connectors may be damaged.

Transistor and Integrated Circuit Replacement

Transistors and IC's should not be replaced unless they are actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement or switching of semiconductor devices may affect the operating parameters of a given circuit, requiring readjustment of variable components.



Power switch must be turned off before removing or replacing semiconductors.

Replacement semiconductors should be of the original type or a direct replacement. Fig. 3-1 shows the lead configuration of the semiconductors used in this instrument. When removing soldered-in transistors, use a suction-type de-soldering tool to remove the solder from the holes in the circuit board.

An extracting tool should be used to remove the in-line-pin package integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. Order Tektronix Part No. 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the IC. Try to avoid having one end of the IC disengaged from the socket before the other end.

Interconnecting Pin Replacement

NOTE

A pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix Part No. 040-0542-00.

To replace a pin which is mounted on a circuit board, first disconnect any pin connectors. Then, unsolder the damage pin and pull it out of the board with a pair of pliers. Be careful not to damage the wiring on the board with too much heat. Ream out the hole in the circuit board with a 0.031-inch drill. Remove the ferrule from the new interconnecting pin and press the new pin into the hole in the circuit board. Position the pin in the same manner as the old pin. If the old pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins.

Pushbutton Switch Replacement

The pushbutton switches are not repairable and should be replaced as a unit if defective. Use a suction-type de-soldering tool to remove solder from the holes in the circuit board when unsoldering the switches.

Cathode-Ray Tube Replacement

WARNING

Use care when handling a CRT. Protective clothing and safety glasses should be worn. Avoid striking it on any object which might cause it to crack or implode. When storing a CRT, place it in a protective carton or set it face down in a protected location on a smooth surface with a soft mat under the faceplate to protect it from scratches.

A. REMOVAL:

1. Remove the bezel assembly, which is held in place with two screws. (The bezel assembly includes a snap-in implosion shield.)

2. For the storage CRT (603), disconnect the storage-element cable connector from the Storage Circuit board.

NOTE

The red and black wires entering the CRT shield are connected to the display-rotation coil inside the shield. They will not hamper CRT removal and need not be unsoldered.

3. Remove the CRT base cover on the rear panel of the instrument. Remove the CRT base-pin socket.

4. Loosen the CRT clamp. The CRT and neck portion of the shield will be removed as a unit, and to facilitate removal, it may be best to remove all hardware from the CRT clamp (bracket and positioning screws, and clamp-tightening hardware).

5. With one hand on the CRT faceplate, push on the CRT base (and neck shield). Slide the CRT and neck shield forward, and at the same time feed the storage-element cable through the slot in the main portion of the CRT shield. Pull the CRT out of the instrument from the front, then remove the neck shield.

B. REPLACEMENT:

1. Slide the neck shield onto the CRT neck.

2. Make sure the soft plastic CRT faceplate supports are in place, then insert the CRT into the main shield while feeding the storage-element cable through the slot in the shield. Before the CRT is completely inserted, slide the CRT clamp over the neck shield.

3. With the CRT fully inserted and loose in the shield, mount the bezel assembly into place and tighten the bezel screws.

4. Mount the CRT clamp and positioning hardware, temporarily leaving it loose.

5. Position the rear of the CRT (socket end) so there is no tilt of the faceplate in relation to the bezel assembly. Tighten the positioning screws, then tighten the clamp hardware.

6. Place the CRT base socket onto the CRT base pins. Replace the cover. If applicable, connect the storage-element cable to the pin connectors on the Storage Circuit board, and connect the deflection leads to the CRT neck pins.

7. Replacing the CRT will require readjustment of the potentiometers in the CRT circuits. Refer to the Circuit Adjustments in this section of the manual.

Power Transformer Replacement

Replace the power transformer only with a direct replacement Tektronix transformer. After the transformer has been replaced, check the power supply output voltages as outlined in the Circuit Adjustments portion of this section. Also, check the CRT operation.

CIRCUIT ADJUSTMENTS

General

This is a procedure to return the circuits of the 603 or 604 monitor to within designed operating capabilities. Adjustments are generally required after a repair has been made, or after long time intervals in which normal aging of components may affect instrument accuracy.

Services Available

Tektronix, Inc. provides complete instrument repair and servicing at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

Test Equipment Required

General. The following test equipment and accessories, or the equivalent, is required for complete circuit adjustment of the 603/604. Specifications given for the test equipment are the minimum necessary for accuracy. All test equipment is assumed to be correctly calibrated and operating within the listed specifications.

Test Equipment Alternatives. Other test equipment can be used in place of that listed here; however, portions of the procedure may need slight alteration to accommodate the substitution. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

Special Calibration Fixtures. Special-purpose Tektronix calibration fixtures are used in this procedure only where they facilitate checking the instrument performance or making the circuit adjustments. These special fixtures are available from Tektronix, Inc. Order by part number through your local Tektronix Field Office or representative.

Test Instruments

1. Precision DC voltmeter, to measure LV supplies. Accuracy, within 0.1%; measurement range, 0 to about 375 volts. For example, a Fairchild Model 7050 Digital Multimeter, or any DC voltmeter meeting the listed requirements.

2. DC voltmeter, to measure HV supply. Minimum sensitivity rating, 20 k Ω /volt; range of at least 4,000 volts full scale, accuracy within 3%. For example, Triplett 630 NA.

3. Test oscilloscope with compatible 1X probe, to monitor test signals and to provide a sweep-generating signal. Bandwidth, DC to 2 MHz (to 8 MHz for checking Z-axis bandwidth); deflection factor, 0.2 to 5 volts/div with 2% accuracy; sweep rates, 0.5 ms and 20 μ s/div (0.2 μ s/Div for checking Z-axis circuit). See Preparation for instrument suggestions.

4. Square-wave generator. Frequency, 1 kHz, 10 kHz, and 100 kHz; risetime, less than 50 nanoseconds; output amplitude, 1 volt. Tektronix Type 106 Square-Wave Generator recommended.

5. Constant-amplitude sine-wave generator. Frequency 350 kHz to above 5 MHz; reference frequency, 50 kHz; output amplitude, from about 0.5 volt to about 5 volts, within 3% as frequency is varied. Tektronix Type 191 Constant-Amplitude Signal Generator recommended.

Accessories

1. Coaxial cables (2). Impedance, 50 Ω ; length, 42 inches; connectors, BNC. Tektronix Part No. 012-0057-01.

2. T connector, BNC. Tektronix Part No. 103-0030-00.

3. 5X attenuator (optional, depending on test equipment used). Impedance, 50 Ω ; accuracy, within 2%; connectors, BNC. Tektronix Part No. 011-0060-01.

Preparation

NOTE

This instrument should be adjusted at an ambient temperature between +20°C and +30°C (between +68°F and +86°F) for best overall accuracy.

Check that the CRT screen (display area) has an 8 X 10-division scribed graticule; install one if necessary. Remove the outside cabinet panels to gain access to internal controls and test points. Connect the monitor to the power source for which it is wired.

A displayed sweep is required for most of the steps in this procedure. A sweep-driving signal (i.e., a linear sawtooth voltage) should be obtained from a test oscilloscope, even if the 603/604 has the sweep option feature, because the option would require internal modification to check the horizontal deflection system. If the test oscilloscope has a front-panel access, use appropriate attenuators to reduce the sawtooth amplitude to between 1 and 3 volts. If a Tektronix 5100-series oscilloscope is used as a test instrument, a sawtooth of the proper amplitude can be obtained by attaching a 1X probe to the + input (R133) of the deflection amplifier circuit. Use the sweep rate (Seconds/Division) as indicated throughout the procedure.

Initial Control Settings

Internal Switches

NOTE

Do not preset internal potentiometers and capacitors unless they are known to be significantly out of adjustment, or unless repairs have been made in the circuit. In these instances, the particular controls can be set to midrange. For location of internal controls and test points, refer to the circuit board illustrations in the diagrams section.

Set the internal attenuator slide switches (Deflection Amplifier board) to the 1:1 (up) position, and set the XY-YT switch to the XY (down) position.

POWER	ON (button in)
STORE (603 only)	Non-store (button out)
STORED BRIGHTNESS (603 only)	Clockwise
INTENSITY	Counterclockwise
FOCUS	Midrange
Vertical Position	Midrange
Horizontal Position	Midrange

1. Check/Adjust Power Supplies

LOW-VOLTAGE SUPPLIES

a. Connect the precision DC voltmeter between the -30-volt test point and ground. Refer to the Regulator circuit board illustration in the Diagrams section.

b. ADJUST—R878, -30 V Adjust, for a voltmeter reading of exactly -30 volts.

c. Connect the precision DC voltmeter between the remaining supply test points and ground, and check for the following accuracies:

+15 V Supply:	+14.7 V to +15.3 V
+215 V Supply:	+209.5 V to +221.5 V
+360 V Supply (603 only):	+342 V to +378 V

d. Disconnect the precision DC voltmeter.

HIGH-VOLTAGE SUPPLY



Turn off instrument power when connecting and disconnecting the DC voltmeter.

e. Connect a DC voltmeter (20 kΩ/volt VOM set to measure at least -3500 volts) between ground and the -3450-volt test point (pin 2 of the CRT base-pin socket).

f. ADJUST—R575, High Voltage, for -3450 volts. Tolerance of the high-voltage supply is -3450 V, ±170 V.

g. Disconnect the DC voltmeter.

2. Check/Adjust CRT Operation

NOTE

Connect the positive-going sweep sawtooth (see Preparation for sweep requirements) to the +X INPUT. Set the sweep rate for 0.5 millisecond/division and check for a horizontal sweep 10 graticule divisions in length. Adjust INTENSITY, FOCUS, and positioning as needed.

CRT BIAS

a. Connect a voltmeter between ground and the collectors of Z-Axis Amplifier output transistors Q554 and Q556.

Adjust the front-panel INTENSITY control to provide a voltmeter reading of 8 volts.

b. ADJUST—R588, Cutoff, until the trace just disappears. Then adjust the INTENSITY control for a trace of normal display brightness.

ASTIGMATISM

c. Temporarily disconnect the sweep from the +X INPUT connector.

d. ADJUST—R594, Astigmatism, for a round spot.

e. Reconnect the sweep signal and adjust the FOCUS control for optimum trace definition.

TRACE ROTATION

f. Move the trace to the center of the graticule.

g. ADJUST—TRACE ROTATION control (located on the rear panel) to align the trace horizontally.

GEOMETRY

h. Position the trace first to the top of the graticule, then to the bottom. Bowing of the trace must not exceed 0.1 division at either position.

i. ADJUST—R596, Geometry, for minimum curvature of the trace.

3. Check/Adjust Storage Operation (603 Only)

OPERATING LEVEL

a. Push the front-panel STORE button in.

b. Connect the DC voltmeter between the flood-gun cathodes (pin 3 of P735) and the Store Level test point (TP680). Record the voltmeter reading so that if necessary the operating level can be returned to the original setting.

NOTE

If CRT performance has been satisfactory, no adjustment of the Store Level control is necessary. Proceed to the Collimation adjustment.

For replacement CRT's, an information card is provided to show the optimum levels established by the factory for the individual CRT. All voltage levels associated with storage operation are made with respect to the flood-gun cathodes.

c. Locate the Writing Threshold (minimum store level) as follows:

1. Turn the INTENSITY control clockwise until the trace starts to defocus rapidly. Press the ERASE button to prepare the target area for storage.
2. Write about 3 lines per division across the screen by slewing the free-running trace vertically with the vertical position control.
3. Carefully check the written lines for breaks or gaps of 0.025 inch or more. If no breaks or gaps are evident after 10 seconds, adjust R670, Store Level, to reduce the operating level by 5 volts.
4. Erase twice, wait 10 seconds, then write again and check for breaks or gaps.
5. Repeat this procedure of decreasing the operating voltage level in 5-volt steps until breaks of about 0.025 inch occur. This is the Writing Threshold. Note the voltage and rotate the Store Level control until the original level noted in step b is reached.

NOTE

Do not change the INTENSITY or FOCUS control settings.

d. Locate the Upper Writing Limit (maximum store level) as follows:

1. Again write about 3 lines per division. Carefully check the stored lines and background for trace spreading or background fade-up. If no trace spreading or background fade-up is evident after 10 seconds, adjust R670, Store Level, to increase the operating level by 5 volts.
2. Erase twice, wait 10 seconds, then write again and check for spreading or fade-up.
3. Repeat this procedure until trace spreading of about 0.025 inch (or background fade-up) occurs. This is the Upper Writing Limit. Note this voltage.

e. Adjust R670 for an operating point midway between the Upper Writing Limit and the Writing Threshold.

f. INTERACTION—Collimation and gain are affected if the change in operating level is significant.

COLLIMATION

g. Move the positive lead of the DC voltmeter from TP680 to CE1 test point TP725.

h. Write the entire screen by slowly positioning the trace vertically. If the screen fails to write, adjust the INTENSITY control slightly clockwise and repeat the process until the screen is fully written. Then turn the INTENSITY control fully counterclockwise.

i. Record the voltmeter reading before an adjustment is made, so that if necessary the collimation voltage can be returned to its original setting.

j. With the screen fully written, turn R730, CE1, fully counterclockwise, noting that the screen edges are brightened and pulled in. Slowly turn R730 clockwise to the point where the bright area just covers the graticule area.

k. Erase the screen and disconnect the DC voltmeter.

l. INTERACTION—Storage capabilities and display geometry should be rechecked if a significant change was made in the collimation voltage.

NON-STORE

m. Fully write the entire screen by slowly positioning the trace vertically.

n. ADJUST—R700, Non-Store, so the background glow quickly (less than 1 second) disappears when the screen is placed in the non-store mode (STORE button out). Repeat the step as necessary to achieve correct adjustment of R700.

4. Check/Adjust Vertical (Y) and Horizontal (X) Deflection Systems

NOTE

The X and Y Gains should be adjusted for full-scale deflection, depending upon the input signals used. As an example, the following procedure shows the proper adjustment for one volt full-scale deflection on both axes. Be sure to place grounding caps on unused inputs.

VERTICAL AXIS GAIN AND COMPENSATION

a. While applying the 0.5-millisecond/division sweep signal to the +X INPUT, apply a 1-kilohertz square-wave signal from the square-wave generator to the +Y INPUT through a coaxial cable and a T connector. Connect another coaxial cable between the T connector and the input to the test oscilloscope to monitor the square-wave signal. Set the test oscilloscope vertical deflection factor to 0.2 volt/division and adjust the square-wave generator for a 1-volt display amplitude (5 displayed divisions on the test oscilloscope). Use an attenuator if necessary.

b. ADJUST—R125, Y Gain, for eight vertical divisions of square-wave display. Push in the STORE button (603 only) and adjust R715, Sensitivity Correction, to match non-store display. Return to non-store mode.

c. Set slide switch S110 (Deflection Amplifier board) to X5.

d. ADJUST—C110, +Y Attenuator Compensation, for minimum roll-off or overshoot of the leading corner of the square-wave display.

e. Set S110 back to the X1 position and move the square-wave signal to the -Y INPUT. Set slide switch S130 to X5.

f. ADJUST—C130, -Y Attenuator Compensation, for optimum square wave.

g. Set S130 back to the X1 position. Change the test oscilloscope sweep rate to 50 microseconds/division. Set the square-wave generator for a 1-volt, 10-kilohertz output and move the square-wave signal to the +Y INPUT.

h. ADJUST—C168, HF Comp, for optimum square wave.

HORIZONTAL AXIS GAIN AND COMPENSATION

i. Move the sweep signal to the +Y INPUT and the square-wave signal to the +X INPUT. Using the signals and conditions given in steps a through h, adjust the following controls:

R325, Y Gain
C310, +X Attenuator Compensation (set S310 to X5)
C330, -X Attenuator Compensation (set S330 to X5)
C368, HF Comp

BANDWIDTH

j. Set the test oscilloscope sweep rate to 0.5 millisecond/division and replace the square-wave generator with the sine-wave generator. Adjust the sine-wave generator for eight vertical divisions of 50-kilohertz display as a reference. Then slowly increase the frequency until the display amplitude is 5.66 divisions. This is the upper -3 dB point.

k. CHECK—Frequency at the upper -3 dB point is at least two megahertz.

l. Move the sweep signal to the +X INPUT and the sine-wave signal to the +Y INPUT. Repeat steps j and k to verify horizontal bandwidth.

PHASE DIFFERENCE

m. Remove the sweep signal and apply the sine-wave signal to both the +Y and +X inputs. Adjust the sine-wave generator and positioning controls so that the display is a diagonal line running from the lower left-hand corner of the graticule to the upper right-hand corner. Adjust R325, X Gain, so the horizontal display width is 8 divisions, then set the sine-wave generator frequency to 500 kilohertz.

n. CHECK—Any opening of the loop indicates a phase shift. The vertical height of the opening at the center of the graticule should not exceed 0.1 division. If necessary, adjust C168 and C368 to optimize phase shift and response.

o. Adjust R325, X Gain, so the horizontal display width is 10 divisions, as it was before making the X-Y phasing check.

p. Remove the sine-wave signal from the X and Y inputs.

5. Check/Adjust Z Axis Amplifier

NOTE

The test oscilloscope should have a bandwidth of at least 8 MHz to permit checking the Z-Axis Amplifier bandwidth and making the HF compensation adjustment.

a. Apply a 20-microsecond/division sweep signal to the +X INPUT. Apply a 50-kilohertz sine-wave signal simultaneously to the +Z INPUT and to the test oscilloscope. Adjust the sine-wave amplitude for one volt peak to peak.

b. Set the INTENSITY control to midrange.

c. ADJUST—R512, Z Gain, so the 603/604 display appears as full-bright line segments that are completely blanked between segments. This indicates a full intensity control range of one volt. This procedure can be repeated using any voltage up to 5 volts to provide the intensity control range.

d. Disconnect the 1X probe from the horizontal deflection circuit of the test oscilloscope and the X INPUT, and connect a 10X probe between the collectors of Z-Axis Amplifier output transistors Q554 and Q556 and the test oscilloscope vertical input. Set the test oscilloscope vertical deflection factor to 0.5 volt/division and the sweep rate to 0.2 microsecond/division. Adjust the INTENSITY control for a 10-volt DC level at the Z-axis output. Replace the sine-wave generator with a square-wave generator, and apply a 100-kilohertz symmetrical square wave to the +Z INPUT. Adjust the square wave amplitude for 4 vertical divisions of test oscilloscope display.

e. ADJUST—C560, Z HF Comp, for minimum roll-off or overshoot of leading edge of square-wave signal.

f. Replace the square-wave generator with the sine-wave generator to check the Z-axis bandwidth. Apply a 500-kilohertz sine-wave to the +Z INPUT. Adjust the INTENSITY control for a 30-volt DC level at the Z-axis output. Adjust the sine-wave amplitude for a test oscilloscope display of 8 vertical divisions. Then increase the frequency until the display amplitude is 5.66 divisions. This is the upper -3 dB point of the bandwidth.

g. CHECK—Frequency at the upper -3 dB point is at least 5 megahertz.

h. Disconnect all test equipment.

SECTION 4

PARTS LISTS AND DIAGRAMS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

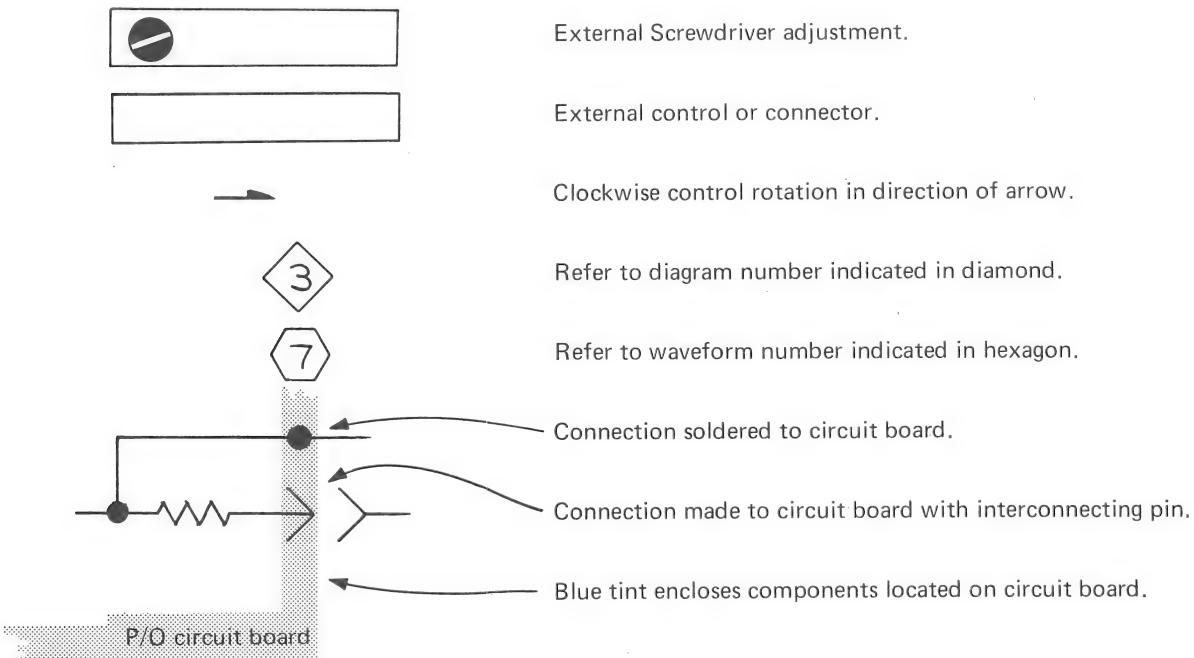
Capacitors = Values one or greater are in picofarads (pF).
 Values less than one are in microfarads (μ F).

Resistors = Ohms (Ω)

Symbols used on the diagrams are based on USA Standard Y32.2-1967.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

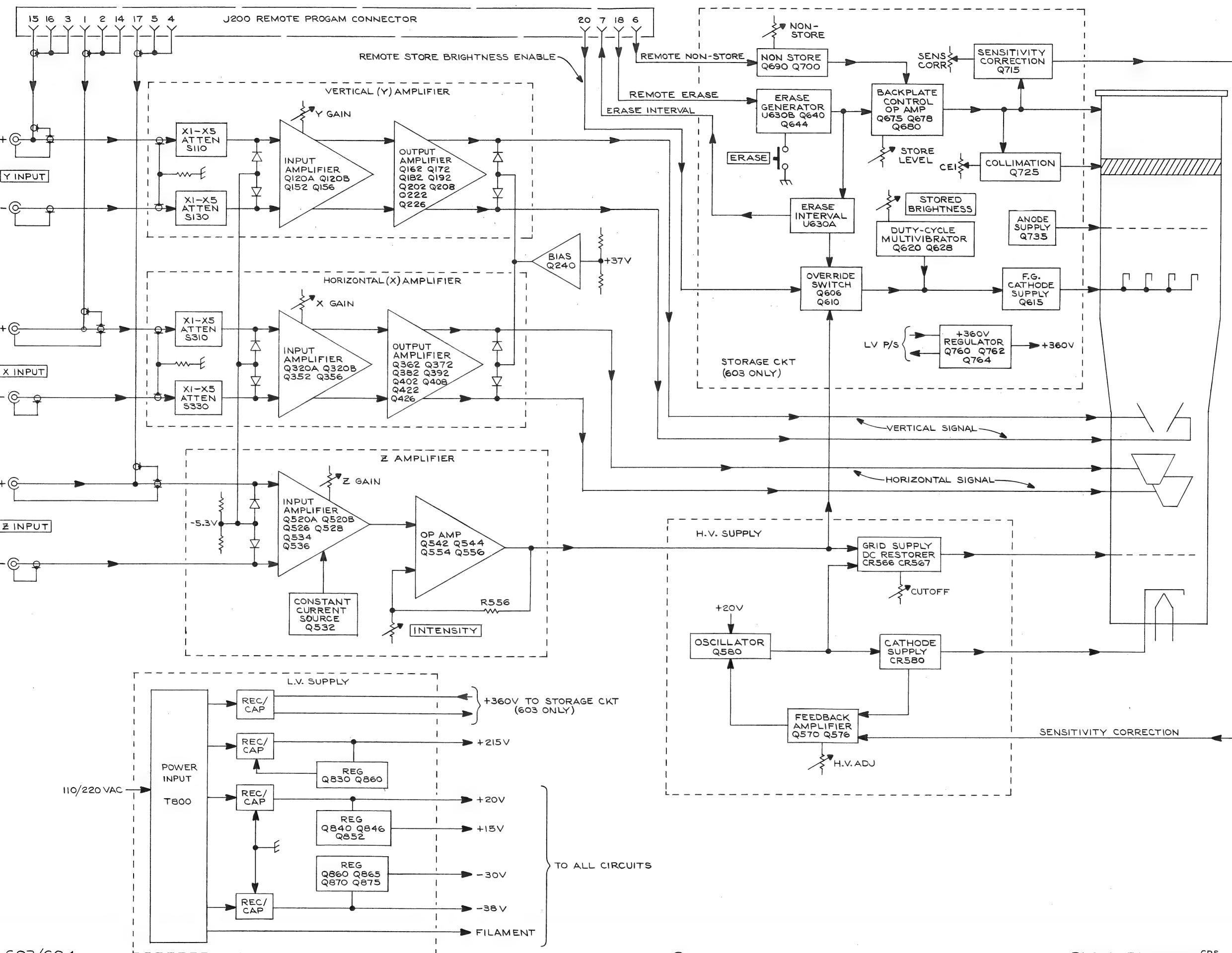
The following special symbols are used on the diagrams:



The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	LR	Inductor/resistor combination
AT	Attenuator, fixed or variable	M	Meter
B	Motor	Q	Transistor or silicon-controlled rectifier
BT	Battery	P	Connector, movable portion
C	Capacitor, fixed or variable	R	Resistor, fixed or variable
CR	Diode, signal or rectifier	RT	Thermistor
DL	Delay line	S	Switch
DS	Indicating device (lamp)	T	Transformer
F	Fuse	TP	Test point
FL	Filter	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
H	Heat dissipating device (heat sink, heat radiator, etc.)	V	Electron tube
HR	Heater	VR	Voltage regulator (zener diode, etc.)
J	Connector, stationary portion	Y	Crystal
K	Relay		
L	Inductor, fixed or variable		

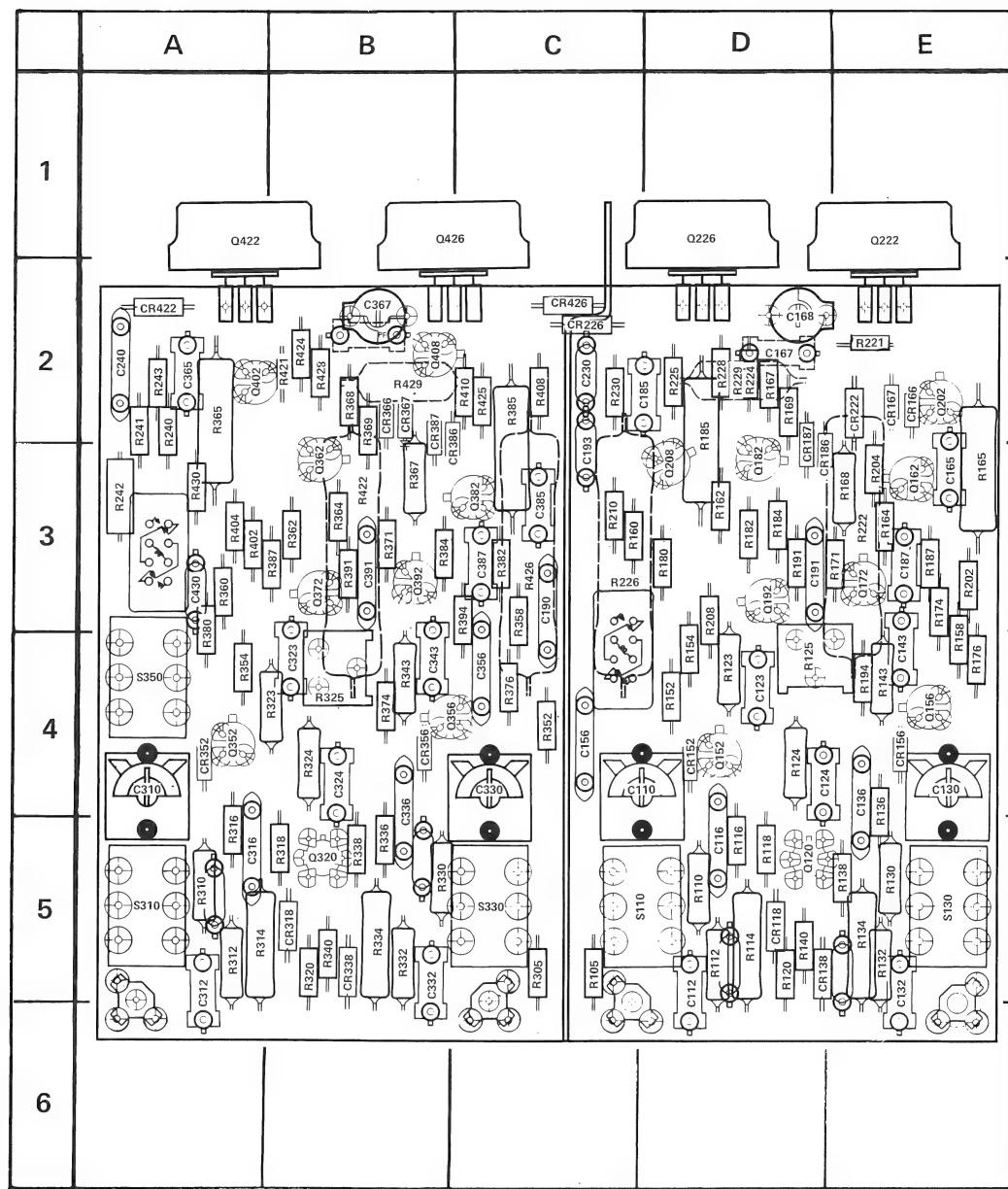




DEFLECTION AMPLIFIER
PARTS LOCATION GRID

603/604

603/604 ASSEMBLY A-1



ELECTRICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
ASSEMBLIES					
A1		670-1811-00			DEFLECTION AMPLIFIER Circuit Board Assembly 603/604
A4		670-1816-00			CONTROL & INTERFACE Circuit Board Assembly 604 (part of)
CAPACITORS					
C110	D4	281-0081-00			1.8-13 pF, Var, Air
C112	D5	283-0601-00			22 pF, Mica, 300 V, 10%
C116	E5	283-0002-00			0.01 pF, Cer, 500 V
C123	D4	281-0544-00			5.6 pF, Cer, 500 V, 10%
C124	D4	281-0519-00			47 pF, Cer, 500 V, 10%
C130	E4	281-0081-00			1.8-13 pF, Var, Air
C132	E5	283-0601-00			22 pF, Mica, 300 V, 10%
C136	E4	283-0002-00			0.01 μF, Cer, 500 V
C143	E4	281-0544-00			5.6 pF, Cer 500 V, 10%
C156	C4	283-0002-00			0.01 μF, Cer, 500 V
C165	E3	281-0661-00			0.8 pF, Cer, 500 V, ±0.1 pF
C167	D2	281-0628-00			15 pF, Cer, 600 V, 5%
C168	D2	281-0166-00			1.9-15.7 pF, Var, Air, 250 V
C185	D2	281-0526-00			1.5 pF, Cer, 500 V, ±0.5 pF
C187	E3	281-0542-00			18 pF, Cer, 500 V, 10%
C190	C3	283-0002-00			0.01 μF, Cer, 500 V
C191	D3	283-0002-00			0.01 μF, Cer, 500 V
C193	C3	283-0002-00			0.01 μF, Cer, 500 V
C230	C2	283-0002-00			0.01 μF, Cer, 500 V
C240	A2	283-0002-00			0.01 μF, Cer, 500 V
C310	A4	281-0081-00			1.8-13 pF, Var, Air
C312	A5	283-0601-00			22 pF, Mica, 300 V, 10%
C316	A5	283-0002-00			0.01 μF, Cer, 500 V

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model Eff	No. Disc	Description
CAPACITORS (cont)					
C323	B4	281-0544-00			5.6 pF, Cer, 500 V, 10%
C324	B4	281-0519-00			47 pF, Cer, 500 V, 10%
C330	C4	281-0081-00			1.8-13 pF, Var, Air
C332	B5	283-0601-00			22 pF, Mica, 300 V, 10%
C336	B4	283-0002-00			0.01 µF, Cer, 500 V
C343	B4	281-0544-00			5.6 pF, Cer, 500 V, 10%
C356	C4	283-0002-00			0.01 µF, Cer, 500 V
C365	A2	281-0526-00			1.5 pF, Cer, 500 V, ±0.5 pF
C367	B2	281-0579-00			21 pF, Cer, 500 V
C368	B2	281-0166-00			1.9-15.7 pF, Var, Air, 250 V
C385	C3	281-0661-00			0.8 pF, Cer, 500 V, ±0.1 pF
C387	C3	281-0542-00			18 pF, Cer, 500 V, 10%
C391	B3	283-0002-00			0.01 µF, Cer, 500 V
C430	A3	283-0002-00			0.01 µF, Cer, 500 V
SCD, DIODES					
CR118	D5	152-0246-00			Silicon, replaceable by CD12676 or FD3375
CR138	D5	152-0246-00			Silicon, replaceable by CD12676 or FD3375
CR152	D4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR156	E4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR166	E2	152-0333-00			Silicon, replaceable by FDH6012
CR167	E2	152-0333-00			Silicon, replaceable by FDH6012
CR186	D3	152-0333-00			Silicon, replaceable by FDH6012
CR187	D3	152-0333-00			Silicon, replaceable by FDH6012
CR222	E2	152-0061-00			Silicon, replaceable by CD8893 or FDH2161
CR226	C2	152-0061-00			Silicon, replaceable by CD8893 or FDH2161
CR318	B5	152-0246-00			Silicon, replaceable by CD12676 or FD3375
CR338	B5	152-0246-00			Silicon, replaceable by CD12676 or FD3375
CR352	A4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR356	B4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR366	B2	152-0333-00			Silicon, replaceable by FDH6012
CR367	B2	152-0333-00			Silicon, replaceable by FDH6012
CR386	B2	152-0333-00			Silicon, replaceable by FDH6012
CR387	B2	152-0333-00			Silicon, replaceable by FDH6012
CR422	A2	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
CR426	C2	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
CONNECTORS					
J110	C6	131-0955-00			Receptacle, electrical, BNC, female
J130	E6	131-0955-00			Receptacle, electrical, BNC, female
J200		131-0569-00			Receptacle, electrical, male (part of)
J310	A6	131-0955-00			Receptacle, electrical, BNC, female
J330	C6	131-0955-00			Receptacle, electrical, BNC, female
TRANSISTORS					
Q120A,B	D5	151-1054-00			Silicon, JFET, N channel
Q152	D4	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q156	E4	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q162	E3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q172	E3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q182	D3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q192	D3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q202	E2	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q208	D3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q222	E1	151-0279-00			Silicon, NPN, replaceable by SE7056

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Description
TRANSISTORS (cont)					
Q226	D1	151-0279-00			Silicon, NPN, replaceable by SE7056
Q240	A2	151-0358-00			Silicon, NPN, replaceable by D44R4
Q320A,B	B5	151-1054-00			Silicon, JFET, N channel
Q352	A4	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q356	C4	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q362	B3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q372	B3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q382	C3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q392	B3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q402	A2	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q408	B2	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q422	A1	151-0279-00			Silicon, NPN, replaceable by SE7056
Q426	B1	151-0279-00			Silicon, NPN, replaceable by SE7056
RESISTORS					
R105	C5	316-0470-00			47 Ω, 1/4 W, 10%
R110	D5	321-0891-00			800 kΩ, 1/8 W, 1%
R112	D5	321-0423-00			249 kΩ, 1/8 W, 1%
R114	D5	322-0481-00			1 MΩ, 1/8 W, 1%
R116	D5	315-0104-00			100 kΩ, 1/8 W, 5%
R118	D5	316-0222-00			2.2 kΩ, 1/8 W, 10%
R120	D5	315-0822-00			8.2 kΩ, 1/8 W, 5%
R123	D4	321-0207-00			1.4 kΩ, 1/8 W, 1%
R124	D4	321-0118-00			165 Ω, 1/8 W, 1%
R125	D4	311-1226-00			2.5 kΩ, Var
R130	E5	321-0891-00			800 kΩ, 1/8 W, 1%
R132	E5	321-0423-00			249 kΩ, 1/8 W, 1%
R134	E5	322-0481-00			1 MΩ, 1/4 W, 1%
R136	E4	315-0104-00			100 kΩ, 1/4 W, 5%
R138	E5	316-0222-00			2.2 kΩ, 1/4 W, 10%
R140	D5	315-0822-00			8.2 kΩ, 1/4 W, 5%
R143	E4	321-0207-00			1.4 kΩ, 1/8 W, 1%
R152	D4	315-0751-00			750 Ω, 1/4 W, 5%
R154	D4	315-0752-00			7.5 kΩ, 1/4 W, 5%
R158	E4	315-0752-00			7.5 kΩ, 1/4 W, 5%
R160	C3	316-0101-00			100 Ω, 1/4 W, 10%
R162	D3	315-0622-00			6.2 kΩ, 1/4 W, 5%
R164	E3	315-0332-00			3.3 kΩ, 1/4 W, 5%
R165	E3	323-0385-00			100 kΩ, 1/2 W, 1%
R167	D2	315-0242-00			2.4 kΩ, 1/4 W, 5%
R168	E3	321-0268-00			6.04 kΩ, 1/8 W, 1%
R169	D2	315-0183-00			18 kΩ, 1/4 W, 5%
R171	E3	315-0153-00			15 kΩ, 1/4 W, 5%
R174	E3	316-0101-00			100 Ω, 1/4 W, 10%
R175 ¹	P2	311-1311-00			1 kΩ, Var

¹604 only.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model Eff	No. Disc	Description
RESISTORS (cont)					
R176	E4	315-0302-00			3 kΩ, 1/4 W, 5%
R180	D3	316-0101-00			100 Ω, 1/4 W, 10%
R182	D3	315-0622-00			6.2 kΩ, 1/4 W, 5%
R184	D3	315-0332-00			3.3 kΩ, 1/4 W, 5%
R185	D2	323-0385-00			100 kΩ, 1/2 W, 1%
R187	E3	316-0102-00			1 kΩ, 1/4 W, 10%
R191	D3	315-0153-00			15 kΩ, 1/4 W, 5%
R194	E4	316-0101-00			100 Ω, 1/4 W, 10%
R202	E3	316-0101-00			100 Ω, 1/4 W, 10%
R204	E3	316-0103-00			10 kΩ, 1/4 W, 10%
R208	D4	316-0101-00			100 Ω, 1/4 W, 10%
R210	C3	316-0103-00			10 kΩ, 1/4 W, 10%
R221	E2	317-0560-00			56 Ω, 1/8 W, 5%
R222	E3	308-0709-00			8 kΩ, 7 W, WW, 3%
R224	D2	316-0180-00			18 Ω, 1/4 W, 10%
R225	D2	315-0560-00			56 Ω, 1/4 W, 5%
R226	C3	308-0709-00			8 kΩ, 7 W, WW, 3%
R228	D2	316-0180-00			18 Ω, 1/4 W, 10%
R229	D2	308-0253-00			1.32 kΩ, 3 W, WW, 5%
R230	C2	316-0221-00			220 Ω, 1/4 W, 10%
R240	A2	315-0104-00			100 kΩ, 1/4 W, 5%
R241	A2	315-0154-00			150 kΩ, 1/4 W, 5%
R243	A2	315-0333-00			33 kΩ, 1/4 W, 5%
R305	C5	316-0470-00			47 Ω, 1/4 W, 10%
R310	A5	321-0891-00			800 kΩ, 1/8 W, 1%
R312	A5	321-0423-00			249 kΩ, 1/8 W, 1%
R314	A5	322-0481-00			1 MΩ, 1/4 W, 1%
R316	A5	315-0104-00			100 kΩ, 1/4 W, 5%
R318	B5	316-0222-00			2.2 kΩ, 1/4 W, 10%
R320	B5	315-0822-00			8.2 kΩ, 1/4 W, 5%
R323	B4	321-0207-00			1.4 kΩ, 1/8 W, 1%
R324	B4	321-0118-00			165 Ω, 1/8 W, 1%
R325	B4	311-1226-00			2.5 kΩ, Var
R330	B5	321-0891-00			800 kΩ, 1/8 W, 1%
R332	B5	321-0423-00			249 kΩ, 1/8 W, 1%
R334	B5	322-0481-00			1 MΩ, 1/4 W, 1%
R336	B5	315-0104-00			100 kΩ, 1/4 W, 5%
R338	B5	316-0222-00			2.2 kΩ, 1/4 W, 10%
R340	B5	315-0822-00			8.2 kΩ, 1/4 W, 5%
R343	B4	321-0207-00			1.4 kΩ, 1/8 W, 1%
R352	C4	315-0751-00			750 Ω, 1/4 W, 5%
R354	A4	315-0752-00			7.5 kΩ, 1/4 W, 5%
R358	C3	315-0752-00			7.5 kΩ, 1/4 W, 5%
R360	A3	316-0101-00			100 Ω, 1/4 W, 10%
R362	B3	315-0622-00			6.2 kΩ, 1/4 W, 5%
R364	B3	315-0332-00			3.3 kΩ, 1/4 W, 5%
R365	A2	323-0385-00			100 kΩ, 1/2 W, 1%
R367	B3	315-0242-00			2.4 kΩ, 1/4 W, 5%
R368	B2	321-0259-00			4.87 kΩ, 1/8 W, 1%
R369	B2	315-0183-00			18 kΩ, 1/4 W, 5%

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Description
RESISTORS (cont)					
R371	B3	315-0153-00			15 kΩ, 1/4 W, 5%
R374 ¹	B4	316-0101-00			100 Ω, 1/4 W, 10%
R375	Q3	311-1311-00			1 kΩ, Var
R376	C4	315-0302-00			3 kΩ, 1/4 W, 5%
R380	A3	316-0101-00			100 Ω, 1/4 W, 10%
R382	C3	315-0622-00			6.2 kΩ, 1/4 W, 5%
R384	B3	315-0332-00			3.3 kΩ, 1/4 W, 5%
R385	C2	323-0385-00			100 kΩ, 1/2 W, 1%
R387	B3	316-0102-00			1 kΩ, 1/4 W, 10%
R391	B3	315-0153-00			15 kΩ, 1/4 W, 5%
R394	C3	316-0101-00			100 Ω, 1/4 W, 10%
R402	A3	316-0101-00			100 Ω, 1/4 W, 10%
R404	A3	316-0103-00			10 kΩ, 1/4 W, 10%
R408	C2	316-0101-00			100 Ω, 1/4 W, 10%
R410	C2	316-0103-00			10 kΩ, 1/4 W, 10%
R421	B2	315-0560-00			56 Ω, 1/4 W, 5%
R422	B3	308-0708-00			5.5 kΩ, 7 W, WW, 3%
R424	B2	316-0150-00			15 Ω, 1/4 W, 10%
R425	C2	317-0560-00			56 Ω, 1/8 W, 5%
R426	C3	308-0708-00			5.5 kΩ, 7 W, WW, 3%
R428	B2	316-0150-00			15 Ω, 1/4 W, 10%
R429	B2	308-0707-00			950 Ω, 3 W, WW, 1%
R430	A3	316-0221-00			220 Ω, 1/4 W, 10%
SWITCHES					
S110	D5	260-0723-00			Slide, DPDT, Attenuator Selector
S130	E5	260-0723-00			Slide, DPDT, Attenuator Selector
S310	A5	260-0723-00			Slide, DPDT, Attenuator Selector
S330	C5	260-0723-00			Slide, DPDT, Attenuator Selector
S350	A4	260-0723-00			Slide, DPDT, XY/YT Selector

¹604 only.

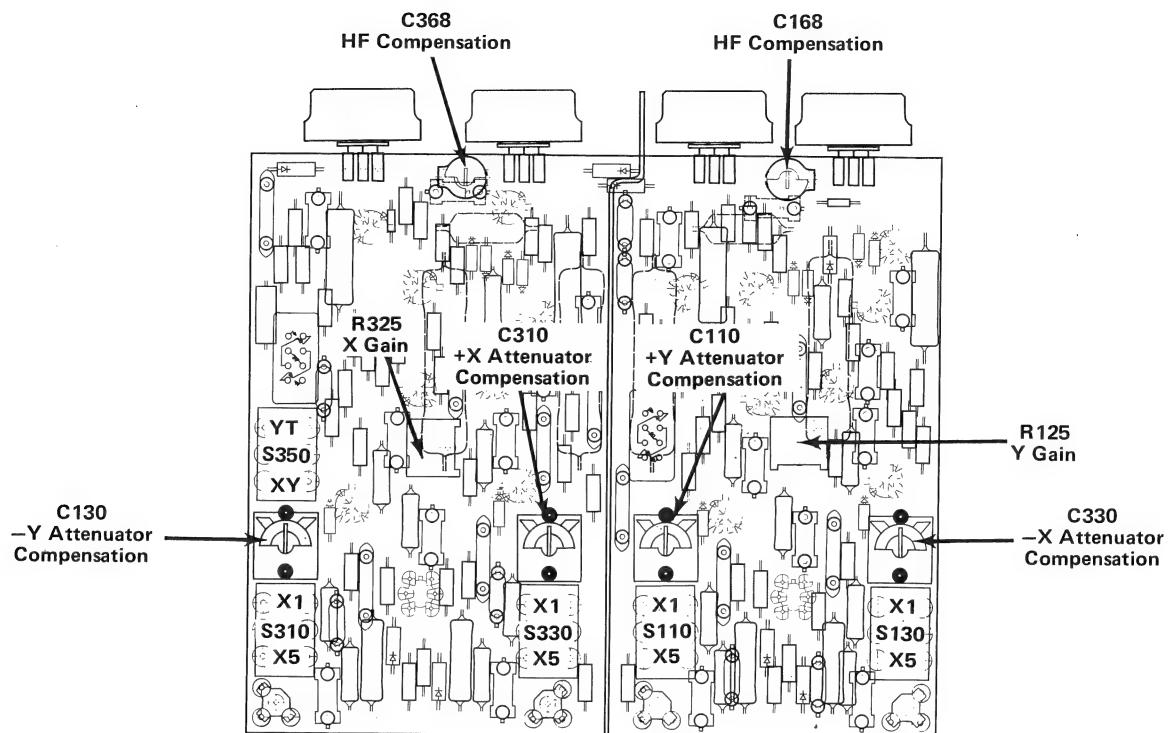
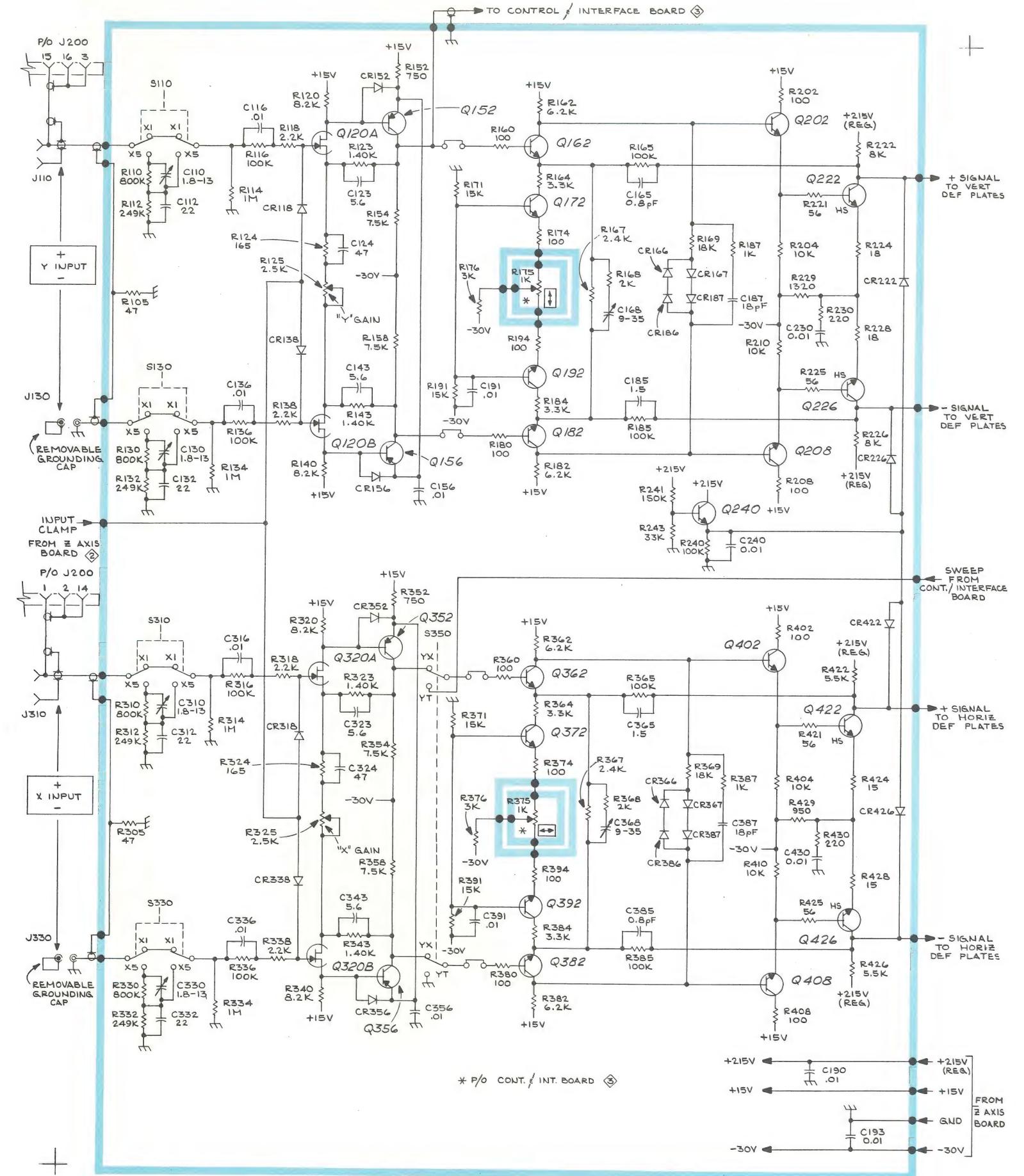


Fig. 4-2. Deflection Amplifier adjustments and test point locations.



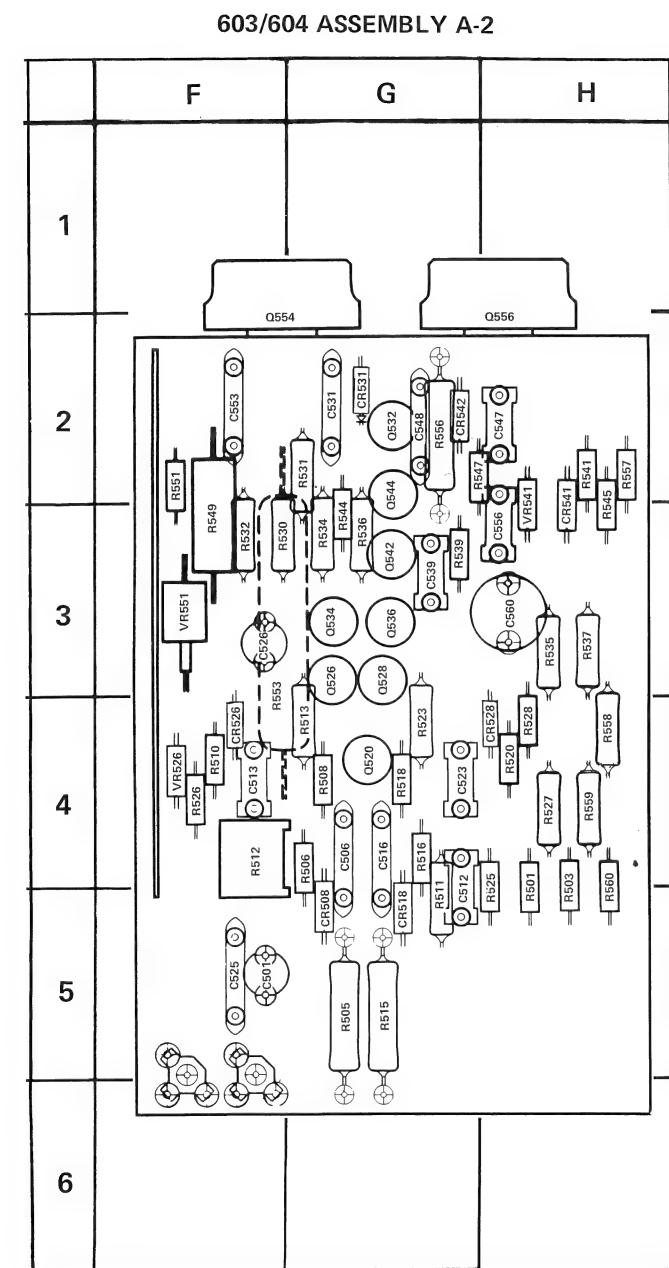


Fig. 4-3. 603/604 Z-Axis Board component location grid

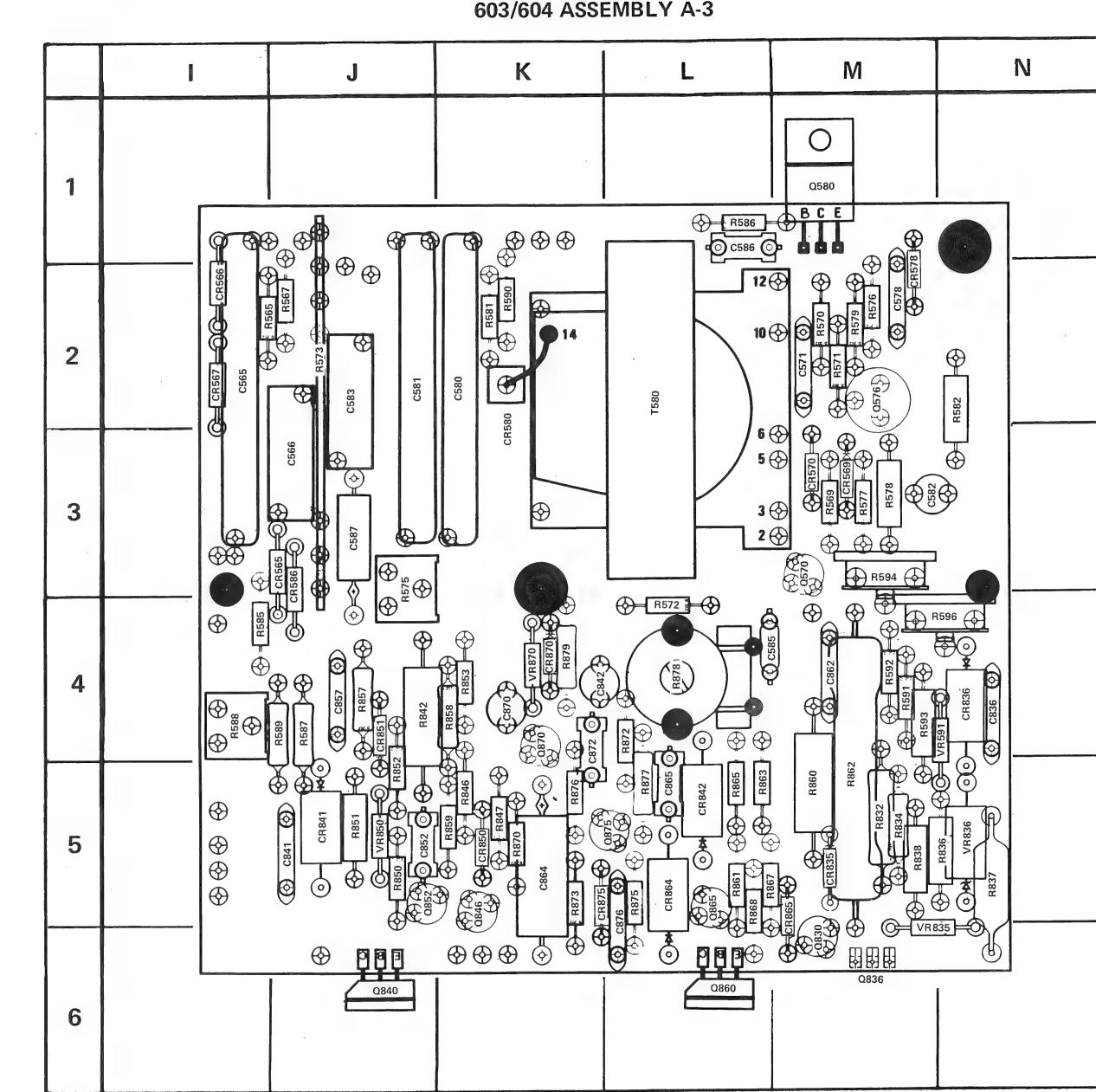


Fig. 4-4. 603/604 High Voltage & Regulators Board component location grid.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
ASSEMBLIES					
A2		670-1812-00			Z-AXIS Circuit Board Assembly 603/604
A3		670-1813-00			HIGH VOLTAGE & REGULATORS Circuit Board Assembly 603/604 (part of)
A4		670-1816-00			CONTROL & INTERFACE Circuit Board Assembly 604 (part of)
CAPACITORS					
C501	F5	290-0534-00			1 μ F, Elect., 35 V, 20%
C506	G4	283-0002-00			0.01 μ F, Cer, 500 V
C512	G5	281-0549-00			68 pF, Cer, 500 V, 10%
C513	F4	281-0621-00			12 pF, Cer, 500 V, 1%
C516	G4	283-0002-00			0.01 μ F, Cer, 500 V
C523	G4	281-0621-00			12 pF, Cer, 500 V, 1%
C525	F5	283-0178-00			0.1 μ F, Cer, 100 V, +80%-20%
C526	F3	290-0534-00			1 μ F, Elect., 35 V, 20%
C531	G2	283-0002-00			0.01 μ F, Cer, 500 V
C539	G3	281-0534-00			3.3 pF, Cer, 500 V, \pm 0.25 pF
C547	H2	281-0629-00			33 pF, Cer, 600 V, 5%
C548	G2	283-0002-00			0.01 μ F, Cer, 500 V
C553	F2	283-0178-00			0.1 μ F, Cer, 100 V, +80%-20%
C556	H3	281-0526-00			1.5 pF, Cer, 500 V, \pm 0.5 pF
C560	H3	281-0160-00			7-25 pF, Var, Cer, 350 V
C565	I2	283-0162-00			0.01 μ F, Cer, 5000 V, +80%-30%
C566	J3	283-0021-00			0.001 μ F, Cer, 5000 V, 20%
C571	M2	283-0010-00			0.05 μ F, Cer, 50 V
C578	M2	283-0026-00			0.2 μ F, Cer, 20 V, +80%-20%
C580	K2	283-0162-00			0.01 μ F, Cer, 5000 V, +80%-30%
C581	J2	283-0162-00			0.01 μ F, Cer, 5000 V, +80%-30%
C582	M2	290-0512-00			22 μ F, Elect., 15 V, 20%
C583	J2	283-0021-00			0.001 μ F, Cer, 5000 V, 20%
C585	L4	283-0026-00			0.2 μ F, Cer, 25 V, +80%-20%
C586	L1	281-0512-00			27 pF, Cer, 500 V, 10%
C587	J3	290-0305-01			3 μ F, Elect., 150 V, 10%
C595	Q4	283-0021-00			0.001 μ F, Cer, 5000 V, 20%
SCD, DIODES					
CR508	G5	152-0246-00			Silicon, replaceable by CD12676 or FD3375
CR518	G5	152-0246-00			Silicon, replaceable by CD12676 or FD3375
CR526	F4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR528	H4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR531	G2	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR541	H3	152-0233-00			Silicon, replaceable by CD61128
CR542	G2	152-0153-00			Silicon, replaceable by FD7003 or CD5574
CR565	J3	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
CR566	I2	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
CR567	I2	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
CR569	M3	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR570	M3	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR578	M2	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR580	K2	152-0409-00			Silicon, replaceable by VG-12X
CR586	J3	152-0061-00			Silicon, replaceable by CD8394 or FDH2161
VR526	F4	152-0149-00			Zener, replaceable by 1N961B, 0.4 W, 10 V, 10%
VR541	H3	152-0166-00			Zener, selected from 1N753A, 0.4 W, 6.2 V, 5%
VR551	F3	152-0101-00			Zener, replaceable by 1N3014B, 1 W, 75 V, 5%
VR591	N4	152-0255-00			Zener, replaceable by 1N978B, 0.4 W, 51 V, 5%

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CONNECTORS					
J200		131-0569-00			Receptacle, electrical, male (part of)
J505	F6	131-0955-00			Receptacle, electrical, BNC, female
J515	F6	131-0955-00			Receptacle, electrical, BNC, female
INDUCTOR					
L598		108-0644-00			Trace rotation
TRANSISTORS					
Q520A,B ^{G4}		151-1054-00			Silicon, JFET, N channel
Q526	G3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q528	G3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q532	G2	151-0301-00			Silicon, PNP, replaceable by 2N2907
Q534	G3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q536	G3	151-0342-00			Silicon, PNP, replaceable by 2N4246
Q542	G3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q544	G2	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q554	F2	151-0270-00			Silicon, PNP, selected from 2N3495
Q556	H2	151-0279-00			Silicon, NPN, replaceable by SE7056
Q570	M3	151-0254-00			Silicon, NPN, replaceable by 2N5308
Q576	M2	151-0134-00			Silicon, PNP, selected from 2N2905
Q580	M1	151-0352-00			Silicon, NPN, replaceable by D44C6
RESISTORS					
R501	H5	315-0392-00			3.9 kΩ, 1/4 W, 5%
R503	H5	315-0183-00			18 kΩ, 1/4 W, 5%
R505	G5	322-0481-00			1 MΩ, 1/4 W, 1%
R506	G4	315-0104-00			100 kΩ, 1/4 W, 5%
R508	G4	316-0102-00			1 kΩ, 1/4 W, 10%
R510	F4	315-0682-00			6.8 kΩ, 1/4 W, 5%
R511	G5	321-0142-00			294 Ω, 1/8 W, 1%
R512	F4	311-1226-00			2.5 kΩ, Var
R513	G4	321-0210-00			1.5 kΩ, 1/8 W, 1%
R515	G5	322-0481-00			1 MΩ, 1/4 W, 1%
R516	G4	315-0104-00			100 kΩ, 1/4 W, 5%
R518	G4	316-0102-00			1 kΩ, 1/8 W, 10%
R520	H4	315-0682-00			6.8 kΩ, 1/4 W, 5%
R523	G4	321-0210-00			1.5 kΩ, 1/8 W, 1%
R525	H5	315-0751-00			750 Ω, 1/4 W, 5%
R526	F4	315-0183-00			18 kΩ, 1/4 W, 5%
R527	H4	321-0158-00			432 Ω, 1/8 W, 1%
R528	H4	315-0183-00			18 kΩ, 1/4 W, 5%
R530	F3	321-0321-00			21.5 kΩ, 1/8 W, 1%
R531	G2	321-0208-00			1.43 kΩ, 1/8 W, 1%
R532	F3	321-0127-00			205 Ω, 1/8 W, 1%
R534	G3	321-0198-00			1.13 kΩ, 1/8 W, 1%
R535	H3	321-0193-00			1 kΩ, 1/8 W, 1%
R536	G3	321-0198-00			1.13 kΩ, 1/8 W, 1%
R537	H3	321-0193-00			1 kΩ, 1/8 W, 1%
R539	G3	316-0101-00			100 Ω, 1/4 W, 10%
R541	H2	315-0392-00			3.9 kΩ, 1/4 W, 5%
R544	G3	316-0101-00			100 Ω, 1/4 W, 10%
R545	H3	316-0472-00			4.7 kΩ, 1/4 W, 10%
R547	G2	316-0181-00			180 Ω, 1/4 W, 10%

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model Eff	No. Disc	Description
RESISTORS (cont)					
R549	F3	303-0563-00			56 kΩ, 1 W, 5%
R551	F2	316-0101-00			100 Ω 1/4 W, 10%
R553	F3	308-0206-00			7.5 kΩ, 5 W, WW, 5%
R556	G2	322-0613-00			20.4 kΩ, 1/4 W, 1%
R557	H2	316-0100-00			10 Ω, 1/4 W, 10%
R558	H4	321-0254-00			4.32 kΩ, 1/8 W, 1%
R559	H4	321-0258-00			4.75 kΩ, 1/8 W, 1%
R560 ₁	H5	315-0202-00			2 kΩ, 1/4 W, 5%
R562 ₁	P3	311-1313-00			2 kΩ, Var
R565	J2	315-0106-00			10 MΩ, 1/4 W, 5%
R567	J2	316-0102-00			1 kΩ, 1/4 W, 10%
R569	M3	316-0153-00			15 kΩ, 1/4 W, 10%
R570	M2	316-0154-00			150 kΩ, 1/4 W, 10%
R571	M2	315-0182-00			1.8 kΩ, 1/4 W, 5%
R572	L4	316-0102-00			1 kΩ, 1/4 W, 10%
R573A					228 kΩ,
R573B					60 MΩ, Thick film
R573C					3.67 MΩ,
R573D					23.6 MΩ,
R575	J3	311-1232-00			50 kΩ, Var
R576	M2	316-0100-00			10 Ω, 1/4 W, 10%
R577	M3	316-0153-00			15 kΩ, 1/4 W, 10%
R578	M3	301-0181-00			180 Ω, 1/2 W, 5%
R579	M2	316-0150-00			15 Ω, 1/4 W, 10%
R581	K2	315-0223-00			22 kΩ, 1/4 W, 5%
R582	N2	307-0093-00			1.2 Ω, 1/2 W, 5%
R585	I4	315-0125-00			1.2 MΩ, 1/4 W, 5%
R586	L1	316-0564-00			560 kΩ, 1/4 W, 10%
R587	J4	321-0410-00			182 kΩ, 1/8 W, 1%
R588	J4	311-1235-00			100 kΩ, Var
R589	J4	321-0371-00			71.5 kΩ, 1/8 W, 1%
R590	K2	316-0104-00			100 kΩ, 1/4 W, 10%
R591	M4	315-0223-00			22 kΩ, 1/4 W, 5%
R592	M4	315-0223-00			22 kΩ, 1/4 W, 5%
R593	M4	301-0113-00			11 kΩ, 1/2 W, 5%
R594 ₁	M3	311-1136-00			100 kΩ, Var
R595 ₁	Q4	311-1312-00			5 MΩ, Var
R596	N4	311-1136-00			100 kΩ, Var
R598		311-1332-00			5 kΩ, Var
TRANSFORMERS					
T580	L2	120-0750-00			H.V. Power
ELECTRON TUBES					
V735 ₂		154-0634-01			CRT standard phosphor
V735 ₁		154-0633-00			CRT standard phosphor

¹604 only.²603 only.

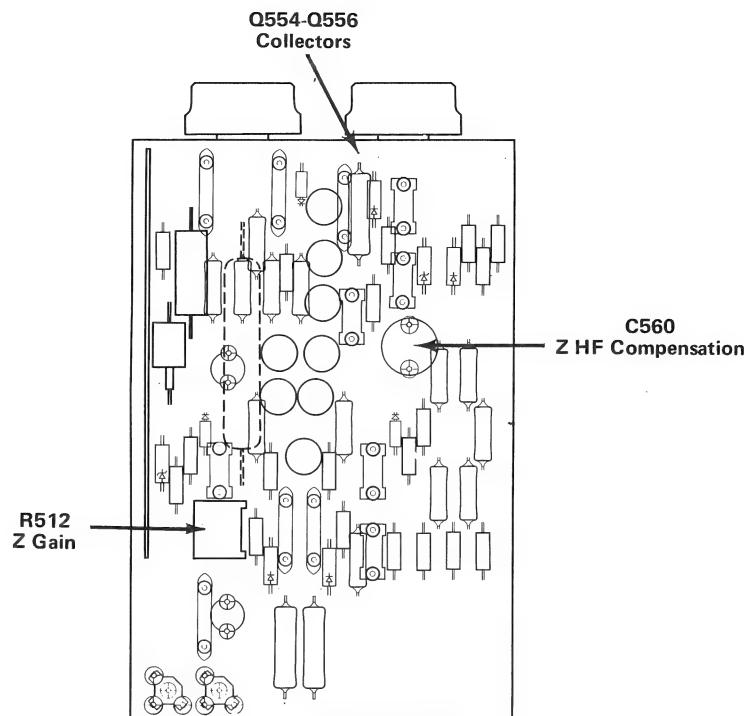


Fig. 4-5. Z-Axis Amplifier adjustments and test point locations.

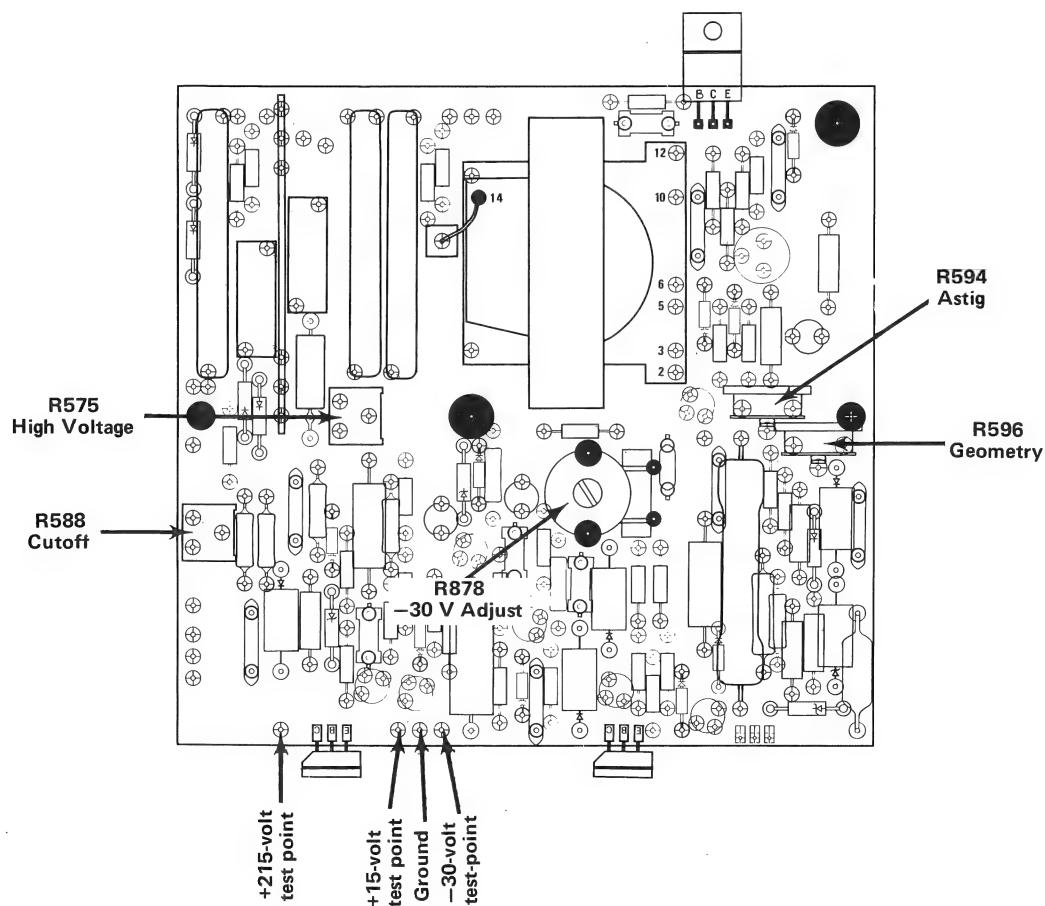
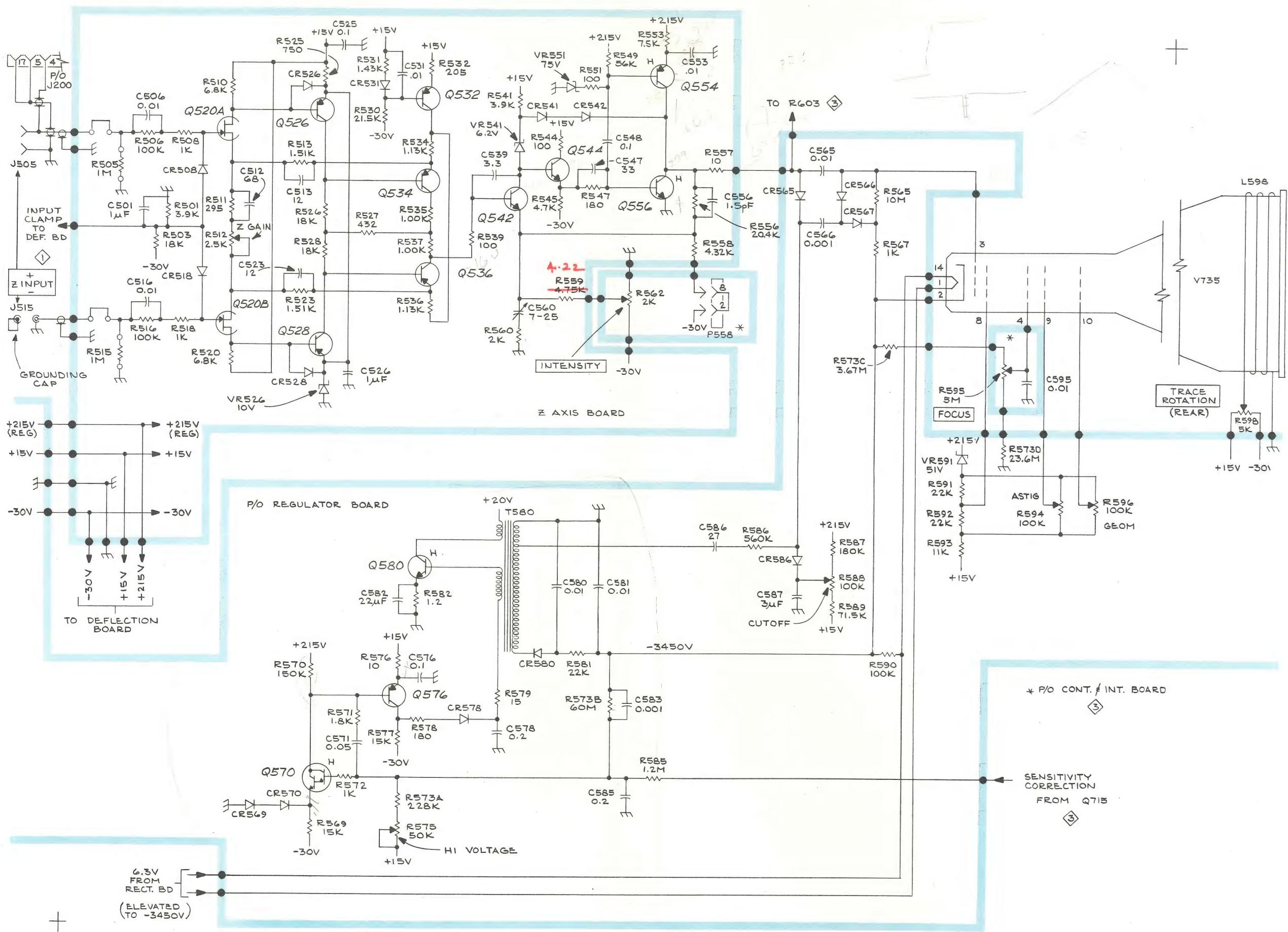
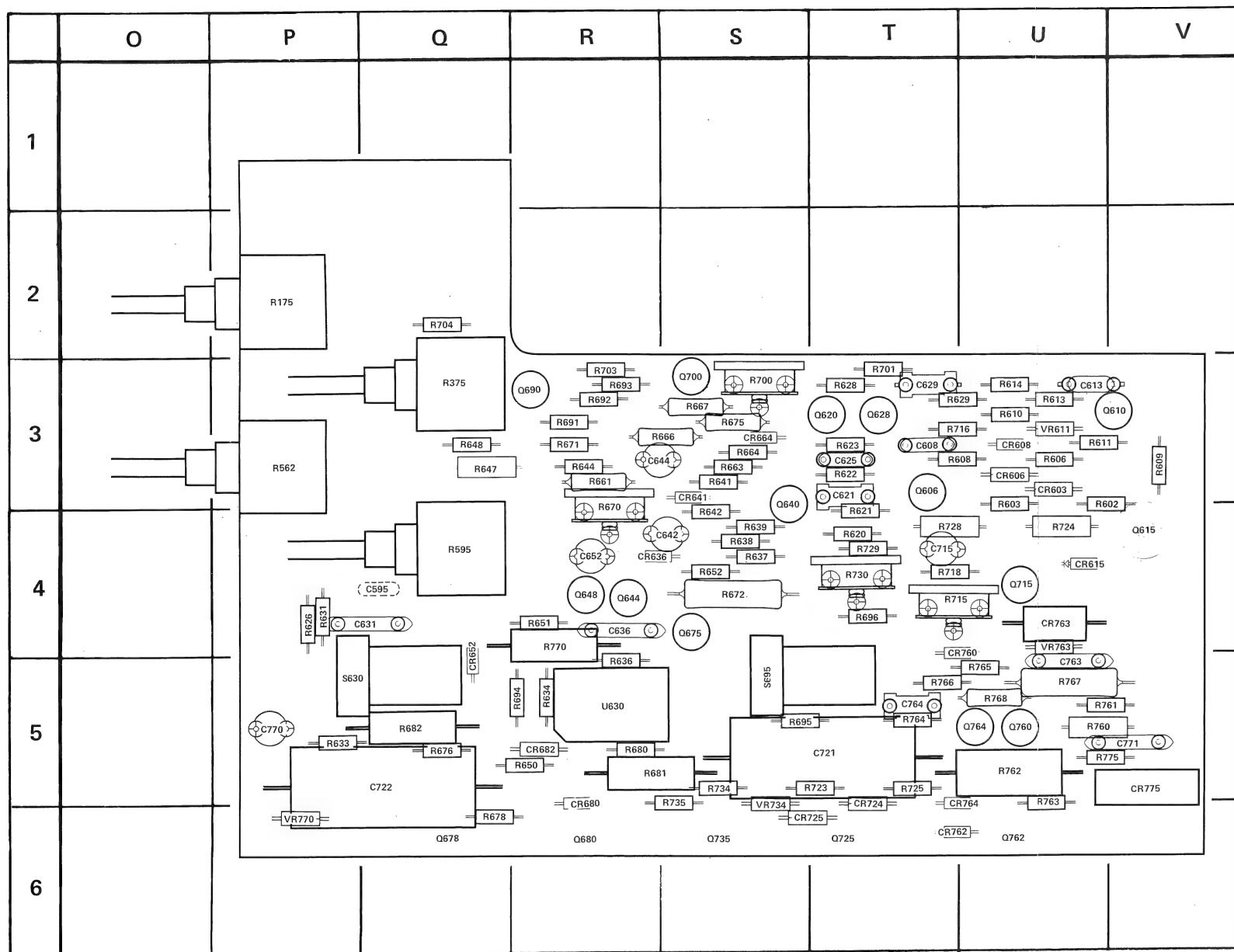


Fig. 4-6. CRT Circuit and Power Supply adjustments and test point locations.



603 ASSEMBLY A-4



604 ASSEMBLY A-4

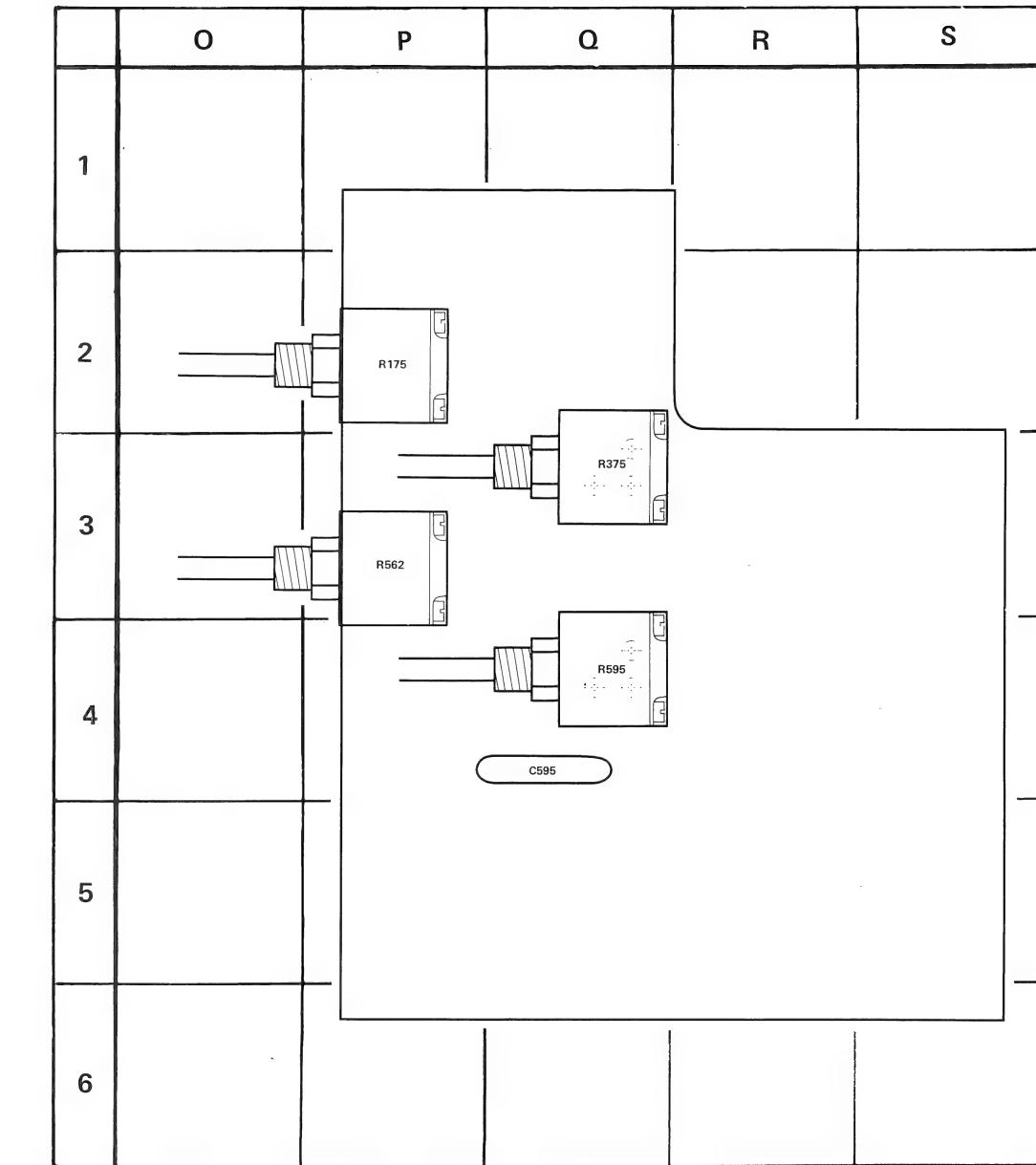


Fig. 4-7. Storage Board (603) and Control & Interface Board (604) component location grid

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Description
ASSEMBLY					
A4		670-1815-00			STORAGE Circuit Board Assembly 603
CAPACITORS					
C608 ¹	T3	283-0067-00			0.001 μ F, Cer, 200 V, 10%
C613 ¹	U3	283-0067-00			0.001 μ F, Cer, 200 V, 10%
C621 ¹	T3	281-0604-00			2.2 pF, Cer, 500 V, ± 0.25 pF
C625 ¹	T3	283-0026-00			0.2 μ F, Cer, 25 V, +80%-20%
C629 ¹	T3	281-0604-00			2.2 pF, Cer, 500 V, ± 0.25 pF
C631 ¹	Q4	283-0002-00			0.01 μ F, Cer, 500 V
C636 ¹	R4	283-0002-00			0.01 μ F, Cer, 500 V
C642 ¹	S4	290-0534-00			1 μ F, Elect., 35 V, 20%
C644 ¹	R3	290-0512-00			22 pF, Elect., 15 V, 20%
C652 ¹	R4	290-0529-00			47 μ F, Elect., 20 V, 20%
C715 ¹	T4	290-0512-00			22 μ F, Elect., 15 V, 20%
C721 ¹	T5	290-0000-00			6.25 μ F, Elect., 300 V
C722 ¹	Q5	290-0000-00			6.25 μ F, Elect., 300 V
C763 ¹	U5	283-0008-00			0.1 μ F, Cer, 500 V
C764 ¹	T5	281-0543-00			270 pF, Cer, 500 V, 10%
C770 ¹	P5	290-0530-00			68 μ F, Elect., 6 V, 20%
C771 ¹	V5	283-0002-00			0.01 μ F, Cer, 500 V
SCD, DIODES					
CR603 ¹	U3	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR606 ¹	U3	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR608 ¹	U3	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR615 ¹	U4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR636 ¹	R4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR641 ¹	S3	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR652 ¹	Q5	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR664 ¹	S3	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR680 ¹	R6	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR682 ¹	R5	152-0107-00			Silicon, replaceable by T160 or 1N647
CR724 ¹	T6	152-0107-00			Silicon, replaceable by T160 or 1N647
CR725 ¹	S6	152-0107-00			Silicon, replaceable by T160 or 1N647
CR760 ¹	U4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR763 ¹	U4	152-0066-00			Silicon, selected from 1N3194
CR764 ¹	U6	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR775 ¹	V5	152-0488-00			Silicon, rectifier bridge, 200 V, 1.5 A
VR611 ¹	U3	152-0168-00			Zener, replaceable by 1N963B, 0.4 W, 12 V, 5%
VR734 ¹	S6	152-0288-00			Zener, selected from 1N988, 0.4 W, 140 V, 5%
VR763 ¹	U4	152-0166-00			Zener, selected from 1N753A, 0.4 W, 6.2 V, 5%
VR770 ¹	P6	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%

¹603 only

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
TRANSISTORS					
Q606 ¹	T3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q610 ¹	V3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q615 ¹	V4	151-0279-00			Silicon, NPN, replaceable by SE7056
Q620 ¹	T3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q628 ¹	T3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q640 ¹	S3	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q644 ¹	R4	151-0302-00			Silicon, NPN, replaceable by 2N2222A
Q648 ¹	R4	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q675 ¹	S4	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q678 ¹	Q6	151-0358-00			Silicon, NPN, replaceable by D44R4
Q680 ¹	R6	151-0358-00			Silicon, NPN, replaceable by D44R4
Q690 ¹	R3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q700 ¹	S3	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q715 ¹	U4	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q725 ¹	T6	151-0358-00			Silicon, NPN, replaceable by D44R4
Q735 ¹	S6	151-0358-00			Silicon, NPN, replaceable by D44R4
Q760 ¹	U5	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q762 ¹	U6	151-0358-00			Silicon, NPN, replaceable by D44R4
Q764 ¹	U5	151-0347-00			Silicon, NPN, replaceable by 2N5551
RESISTORS					
R175 ¹	P2	311-1311-00			1 kΩ, Var
R375 ¹	Q3	311-1311-00			1 kΩ, Var
R562 ¹	P3	311-1313-00			2 kΩ, Var
R595 ¹	Q4	311-1312-00			5 MΩ, Var
R602 ¹	V3	315-0202-00			2 kΩ, 1/4 W, 10%
R603 ¹	U3	316-0274-00			270 kΩ, 1/4 W, 10%
R606 ¹	U3	316-0105-00			1 MΩ, 1/4 W, 10%
R608 ¹	U3	316-0472-00			4.7 kΩ, 1/4 W, 10%
R609 ¹	V3	316-0471-00			470 Ω, 1/4 W, 10%
R610 ¹	U3	315-0103-00			10 kΩ, 1/4 W, 5%
R611 ¹	U3	316-0393-00			39 kΩ, 1/4 W, 10%
R613 ¹	U3	316-0223-00			22 kΩ, 1/4 W, 10%
R614 ¹	U3	315-0103-00			10 kΩ, 1/4 W, 5%
R620 ¹	T4	316-0223-00			22 kΩ, 1/4 W, 10%
R621 ¹	T4	315-0125-00			1.2 MΩ, 1/4 W, 5%
R622 ¹	T3	315-0202-00			2 kΩ, 1/4 W, 5%
R623 ¹	T3	316-0104-00			100 kΩ, 1/4 W, 10%
R625 ¹		311-1316-00			20 kΩ, Var
R626 ¹	P4	315-0123-00			12 kΩ, 1/4 W, 5%
R628 ¹	T3	316-0104-00			100 kΩ, 1/4 W, 10%
R629 ¹	U3	315-0125-00			1.2 MΩ, 1/4 W, 5%
R631 ¹	P4	316-0471-00			470 Ω, 1/4 W, 10%
R633 ¹	P5	316-0393-00			39 kΩ, 1/4 W, 10%
R634 ¹	R5	316-0393-00			39 kΩ, 1/4 W, 10%
R636 ¹	R5	316-0102-00			1 kΩ, 1/4 W, 10%
R637 ¹	S4	315-0103-00			10 kΩ, 1/4 W, 5%
R638 ¹	S4	316-0102-00			1 kΩ, 1/4 W, 10%
R639 ¹	S4	315-0392-00			3.9 kΩ, 1/4 W, 5%
R641 ¹	S3	315-0103-00			10 kΩ, 1/4 W, 5%

¹603 only.

ELECTRICAL PARTS LIST (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Description
RESISTORS (cont)				
R642 ¹	S4	316-0682-00		6.8 kΩ, 1/4 W, 10%
R644 ¹	R3	316-0121-00		120 kΩ, 1/2 W, 5%
R647 ¹	Q3	301-0122-00		1.2 kΩ, 1/2 W, 5%
R648 ¹	Q3	316-0331-00		330 Ω, 1/4 W, 10%
R650 ¹	R5	316-0393-00		39 kΩ, 1/4 W, 10%
R651 ¹	R4	315-0183-00		18 kΩ, 1/4 W, 5%
R652 ¹	S4	316-0101-00		100 Ω, 1/4 W, 10%
R661 ¹	R3	321-0365-00		61.9 kΩ, 1/8 W, 1%
R663 ¹	S4	315-0124-00		120 kΩ, 1/4 W, 5%
R664 ¹	S4	315-0473-00		47 kΩ, 1/4 W, 5%
R666 ¹	S3	321-0304-00		14.3 kΩ, 1/8 W, 1%
R667 ¹	S3	321-0350-00		43.2 kΩ, 1/8 W, 1%
R670 ¹	R4	311-1314-00		5 kΩ, Var
R671 ¹	R3	316-0331-00		330 Ω, 1/4 W, 10%
R672 ¹	S4	323-0452-00		499 kΩ, 1/2 W, 1%
R675 ¹	S3	321-0410-00		182 kΩ, 1/8 W, 1%
R676 ¹	Q5	316-0101-00		100 Ω, 1/4 W, 10%
R600 ¹	Q6	316-0101-00		100 Ω, 1/4 W, 10%
R680 ¹	R5	316-0101-00		100 Ω, 1/4 W, 10%
R681 ¹	R5	303-0823-00		82 kΩ, 1 W, 5%
R682 ¹	Q5	303-0823-00		82 kΩ, 1 W, 5%
R691 ¹	R3	315-0323-00		3.3 kΩ, 1/4 W, 5%
R692 ¹	R3	315-0392-00		3.9 kΩ, 1/4 W, 5%
R693 ¹	R3	315-0683-00		68 kΩ, 1/4 W, 5%
R694 ¹	R5	316-0471-00		470 Ω, 1/4 W, 10%
R695 ¹	S5	315-0103-00		10 kΩ, 1/4 W, 5%
R696 ¹	T4	315-0163-00		16 kΩ, 1/4 W, 5%
R700 ¹	S3	311-1315-00		25 kΩ, Var
R701 ¹	T3	315-0103-00		10 kΩ, 1/4 W, 5%
R703 ¹	R3	316-0334-00		330 kΩ, 1/4 W, 10%
R704 ¹	Q2	316-0334-00		330 kΩ, 1/4 W, 10%
R715 ¹	T4	311-1314-00		5 kΩ, Var
R716 ¹	U3	315-0154-00		150 kΩ, 1/4 W, 5%
R718 ¹	T4	315-0123-00		12 kΩ, 1/4 W, 5%
R723 ¹	T5	315-0473-00		47 kΩ, 1/4 W, 5%
R724 ¹	U4	301-0823-00		82 kΩ, 1/2 W, 5%
R725 ¹	T5	316-0101-00		100 Ω, 1/4 W, 10%
R728 ¹	T4	301-0134-00		130 kΩ, 1/2 W, 5%
R729 ¹	T4	316-0273-00		27 kΩ, 1/4 W, 10%
R730 ¹	T4	311-1136-00		100 kΩ, Var
R734 ¹	S5	315-0623-00		62 kΩ, 1/4 W, 5%
R735 ¹	S6	316-0101-00		100 Ω, 1/4 W, 10%
R760 ¹	U5	301-0224-00		220 kΩ, 1/2 W, 5%
R761 ¹	U5	316-0474-00		470 kΩ, 1/4 W, 10%
R762 ¹	U5	305-0183-00		18 kΩ, 2 W, 5%
R763 ¹	U6	315-0161-00		160 Ω, 1/4 W, 5%
R764 ¹	T5	315-0753-00		75 kΩ, 1/4 W, 5%
R765 ¹	U5	316-0472-00		4.7 kΩ, 1/4 W, 10%
R766 ¹	T5	316-0471-00		470 Ω, 1/4 W, 10%
R767 ¹	U5	323-0437-00		348 kΩ, 1/2 W, 1%
R768 ¹	U5	321-0352-00		45.3 kΩ, 1/8 W, 1%
R770 ¹	R4	303-0271-00		270 Ω, 1 W, 5%
R775 ¹	U5	316-0104-00		100 kΩ, 1/4 W, 10%

¹603 only.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model Eff	No. Disc	Description
SWITCHES					
S630 ¹	P5	260-1308-00			Push, ERASE
S695 ¹	S5	260-1211-00			Push-push, STORE/NON STORE
INTEGRATED CIRCUIT					
U630 ¹	R5	156-0149-00			Dual 4-input nand Schmitt trig., replaceable by SN7413N

¹603 only.

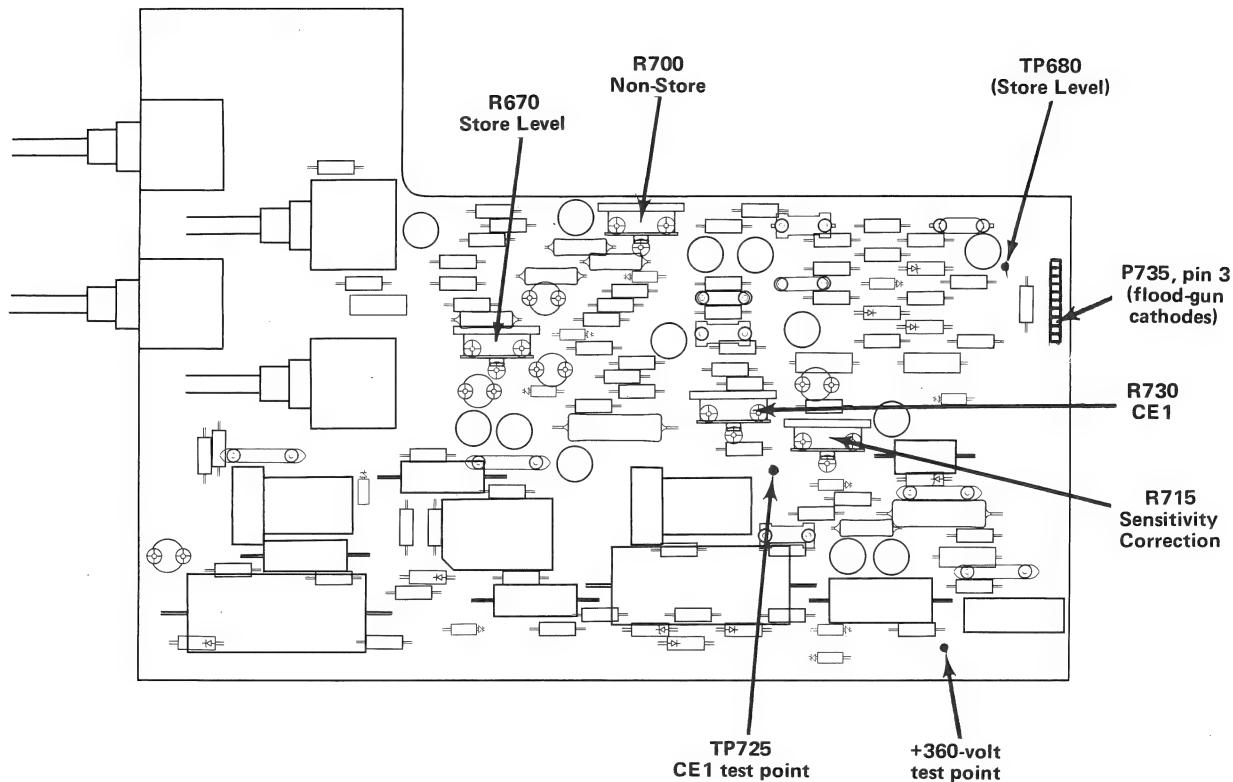
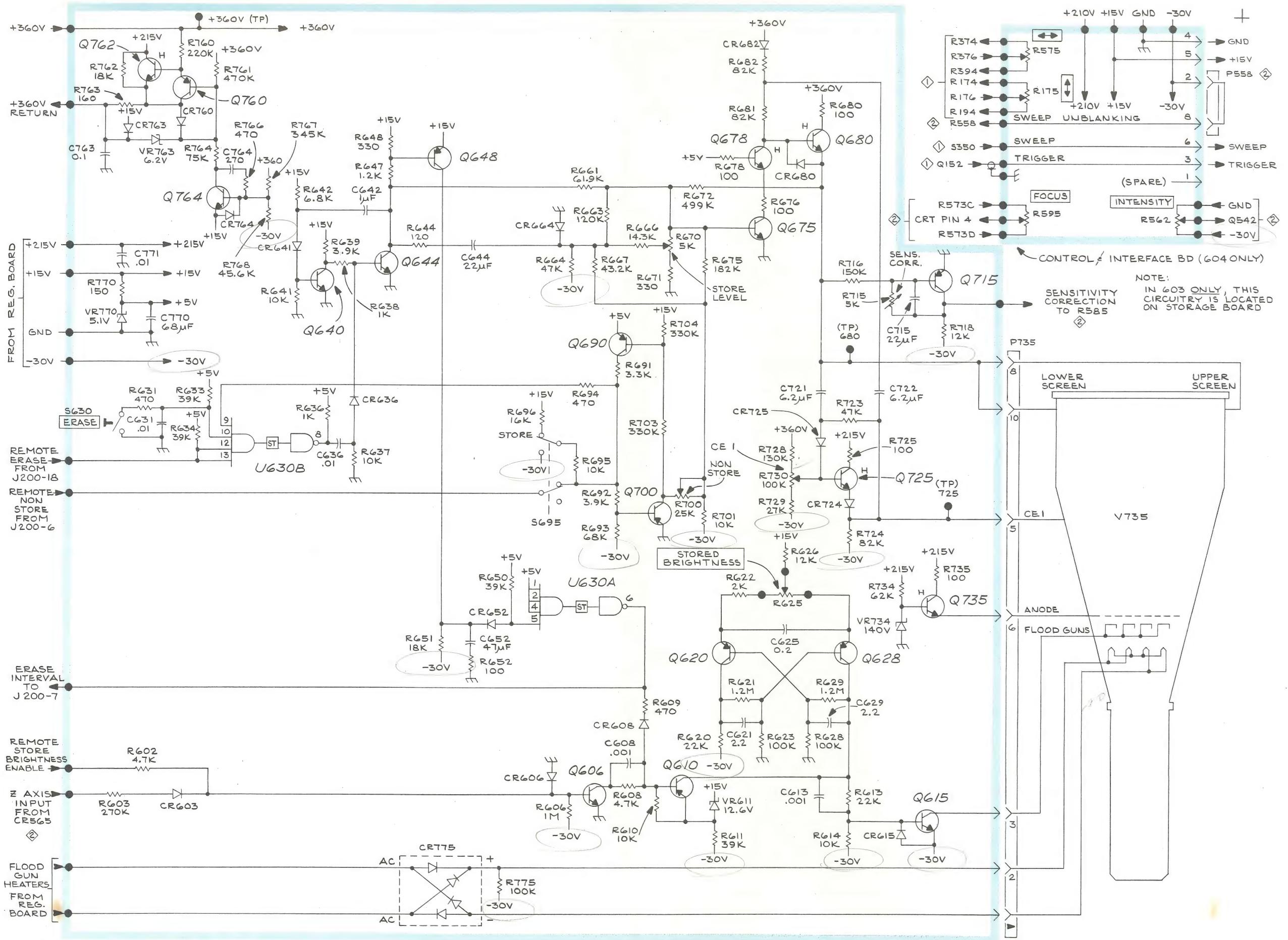
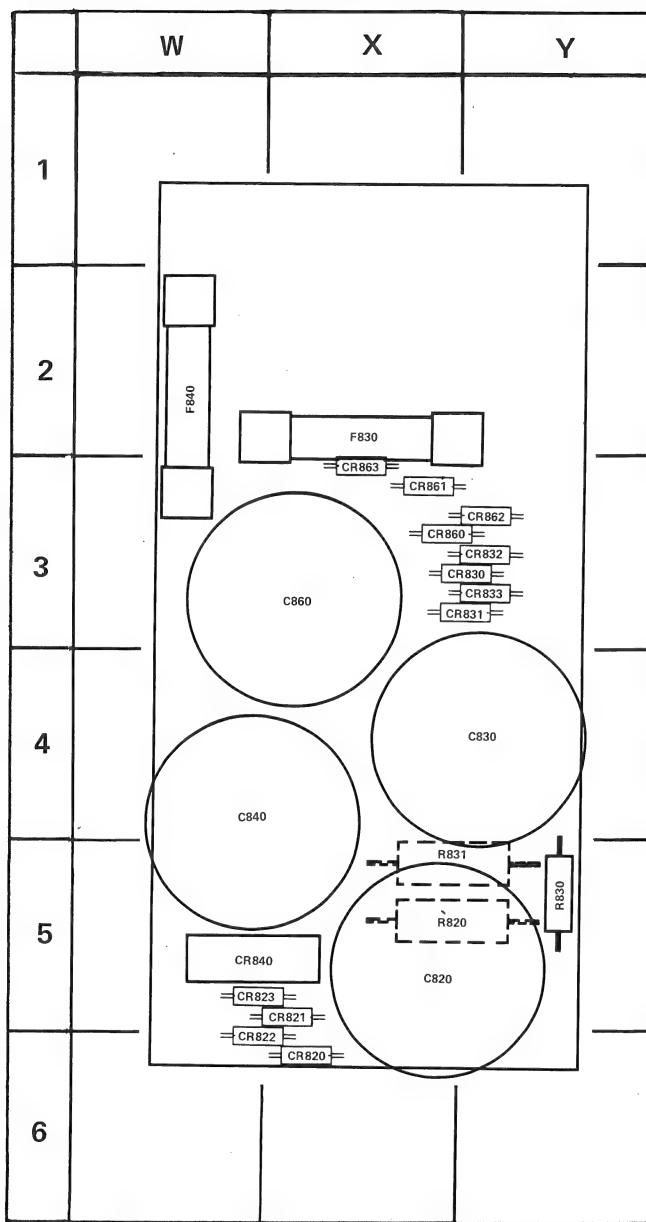


Fig. 4-8. Storage Circuit adjustments and test point locations.



603/604 ASSEMBLY A-5



NOTE

See Fig. 4-4 (Assembly A-3) for location of components on L.V. Regulator board.

Fig. 4-9. Power Input and Rectifiers Board component location grid.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
ASSMBLIES					
A3		670-1813-00			HIGH VOLTAGE & REGULATORS Circuit Baord Assembly
A5		670-1814-00			603/604 (part of)
A5		670-1859-00			POWER INPUT & RECTIFIERS Circuit Board Assembly 603
					POWER INPUT & RECTIFIERS Circuit Board Assembly 604
CAPACITORS					
C820	X5	290-0569-00			50 μ F, Elect., 250 V, +50%-10%
C830	Y4	290-0511-01			250 μ F, Elect., 250 V, +75-10%
C836	N4	283-0178-00			0.1 μ F, Cer, 100 V, +80%-20%
C840	W4	290-0571-00			5000 μ F, Elect., 25 V, +100%-10%
C841	J5	283-0081-00			0.1 μ F, Cer, 25 V, +80%-20%
C842	K4	290-0536-00			10 μ F, Elect., 25 V, 20%
C852	J5	281-0550-00			120 pF, Cer, 500 V, 10%
C857	J4	283-0002-00			0.01 μ F, Cer, 500 V
C860	X3	290-0570-00			500 μ F, Elect., 50 V, +75-10%
C862	M4	283-0111-00			0.1 μ F, Cer, 500 V
C864	K5	290-0175-00			10 μ F, Elect., 35 V, 20%
C865	L5	281-0543-00			270 pF, Cer, 500 V, 10%
C870	K4	290-0512-00			22 μ F, Elect., 15 V, 20%
C872	K4	281-0504-00			10 pF, Cer, 500 V, 10%
C876	L6	283-0002-00			0.01 μ F, Cer, 500 V
SCD, DIODES					
CR820	X6	152-0107-00			Silicon, replaceable by T160 or 1N647
CR821	X5	152-0107-00			Silicon, replaceable by T160 or 1N647
CR822	W6	152-0107-00			Silicon, replaceable by T160 or 1N647
CR823	W5	152-0107-00			Silicon, replaceable by T160 or 1N647
CR830	Y3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR831	Y3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR832	Y3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR833	Y3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR835	M5	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR836	N4	152-0066-00			Silicon, selected from 1N3194
CR840	W5	152-0488-00			Silicon, rectifier bridge, 200 V, 1.5 A
CR841	J5	152-0066-00			Silicon, selected from 1N3194
CR842	L5	152-0066-00			Silicon, selected from 1N3194
CR850	K5	152-0141-02			Silicon, replaceable by 1N4152
CR851	J4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR860 ¹	X3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR861 ¹	X3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR862 ¹	Y3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR863 ¹	X3	152-0107-00			Silicon, replaceable by T160 or 1N647
CR864	L5	152-0066-00			Silicon, selected from 1N3194
CR865	M5	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR870	K4	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR875	K5	152-0185-00			Silicon, selected from 1N4152 or 1N3605
VR835	M6	152-0166-00			Zener, selected from 1N735A, 0.4 W, 6.2 V, 5%
VR836	N5	152-0291-00			Zener, replaceable by 1N3027B, 1 W, 20 V, 5%
VR850	J5	152-0357-00			Zener, replaceable by 1N983B, 0.4 W, 82 V, 5%
VR870	K4	152-0227-00			Zener, selected from 1N753A, 0.4 W, 6.2 V, 5%

¹603 only.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
FUSES					
F800		159-0003-00			Cartridge, 1.6 A, 3 AG, slo-blo
F830	X2	159-0028-00			Cartridge, 1/4 A, 3 AG, fast-blo
F840	W2	159-0019-00			Cartridge, 1 A, 3 AG, slo-blo
TRANSISTORS					
Q830	M6	151-0228-00			Silicon, PNP, selected from 2N4888
Q836	M6	151-0358-00			Silicon, NPN, replaceable by D44R4
Q840	J6	151-0331-00			Silicon, NPN, replaceable by D40C8 or selected from D40C5
Q846	K5	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q852	J5	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q860	L6	151-0331-00			Silicon, NPN, replaceable by D40C8 or selected from D40C5
Q865	L5	151-0341-00			Silicon, NPN, replaceable by 2N3565
Q870	K4	151-0342-00			Silicon, PNP, replaceable by 2N4249
Q875	L5	151-0342-00			Silicon, PNP, replaceable by 2N4249
RESISTORS					
R820 ¹	X5	304-0683-00			68 kΩ, 1 W, 10%
R830	Y5	302-0150-00			15 Ω, 1/2 W, 10%
R831	X5	304-0823-00			82 kΩ, 1 W, 10%
R832	M5	322-0414-00			200 kΩ, 1/4 W, 1%
R834	M5	321-0351-00			44.2 kΩ, 1/8 W, 1%
R836	N5	301-0102-00			1 kΩ, 1/2 W, 5%
R837	N5	308-0281-00			1.8 kΩ, 3 W, WW, 5%
R838	M5	301-0300-00			30 Ω, 1/2 W, 5%
R842	J4	307-0007-00			2.7 Ω, 1 W, 10%
R846	K5	315-0561-00			560 Ω, 1/4 W, 5%
R847	K5	316-0153-00			15 kΩ, 1/4 W, 10%
R850	J5	316-0823-00			82 kΩ, 1/4, 10%
R851	J5	301-0683-00			68 kΩ, 1/2 W, 5%
R852	J5	316-0471-00			470 Ω, 1/4 W, 10%
R853	K4	316-0103-00			10 kΩ, 1/4 W, 10%
R857	J4	321-0260-00			4.99 kΩ, 1/8 W, 1%
R858	K4	321-0289-00			10 kΩ, 1/8 W, 1%
R859	K5	316-0101-00			100 Ω, 1/4 W, 10%
R860	M5	307-0015-00			3.3 Ω, 1 W, 5%
R861	L5	316-0471-00			470 Ω, 1/4 W, 10%
R862	M5	307-0335-00			150 Ω, 0.4 W, 5%
R863	L5	316-0273-00			27 kΩ, 1/4 W, 10%
R865	L5	316-0331-00			330 Ω, 1/4 W, 10%
R867	L5	315-0621-00			620 Ω, 1/4 W, 5%
R868	L5	316-0101-00			100 Ω, 1/4 W, 10%
R870	K5	315-0562-00			5.6 kΩ, 1/4 W, 5%
R872	L4	316-0221-00			220 Ω, 1/4 W, 10%
R873	K5	316-0102-00			1 kΩ, 1/4 W, 10%
R875	L5	316-0101-00			100 Ω, 1/4 W, 10%
R876	K5	316-0101-00			100 Ω, 1/4 W, 10%
R877	L5	321-0256-00			4.53 kΩ, 1/8 W, 1%
R878	L4	311-1124-00			250 Ω, Var
R879	K4	321-0202-00			1.24 kΩ, 1/8 W, 1%

¹603 only.

ELECTRICAL PARTS LIST (cont)

Ckt No.	Grid Loc	Tektronix Part No.	Serial/Model Eff	No. Disc	Description
SWITCHES					
S800		260-1222-00			Push-pull DPDT, POWER PULL ON
S801		260-0413-00			Thermostatic, open 79.4° C, close 68.3° C
TRANSFORMERS					
T800 ¹		120-0748-00			Power
T800 ²		120-0749-00			Power

¹603 only.
²604 only.

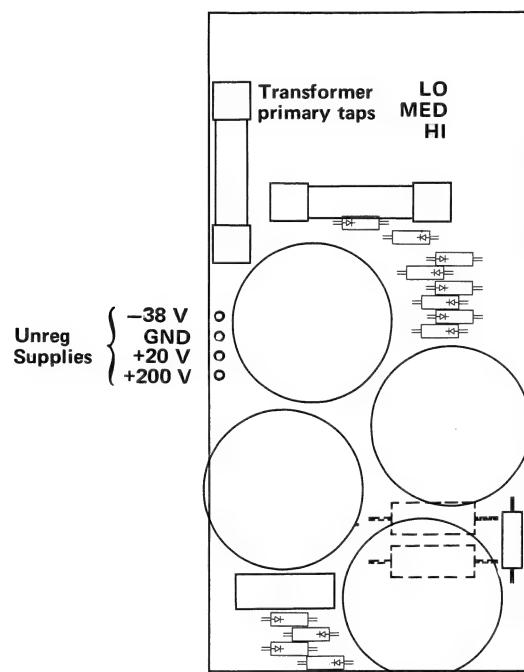
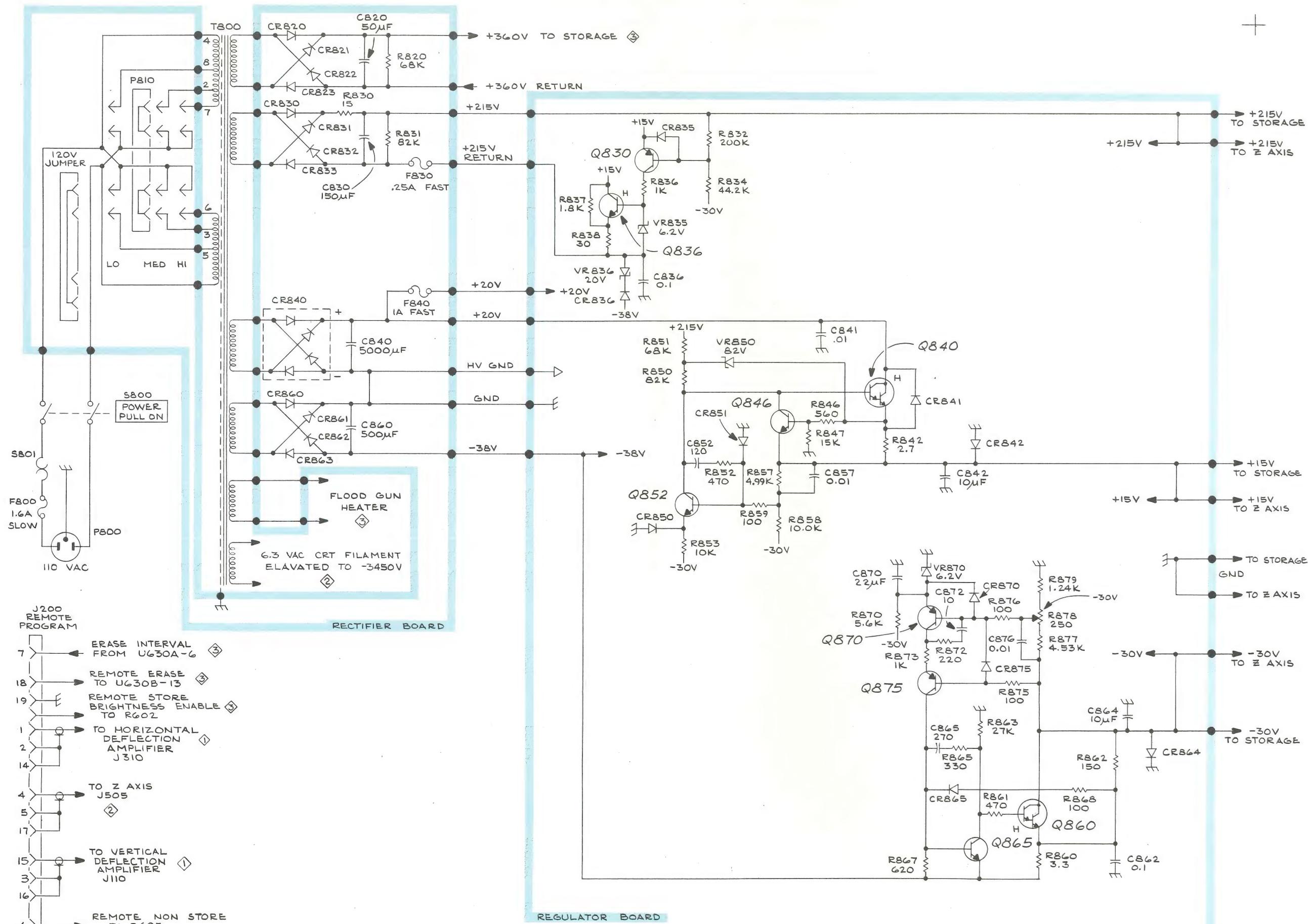


Fig. 4-10. Transformer primary taps and power supply test points.



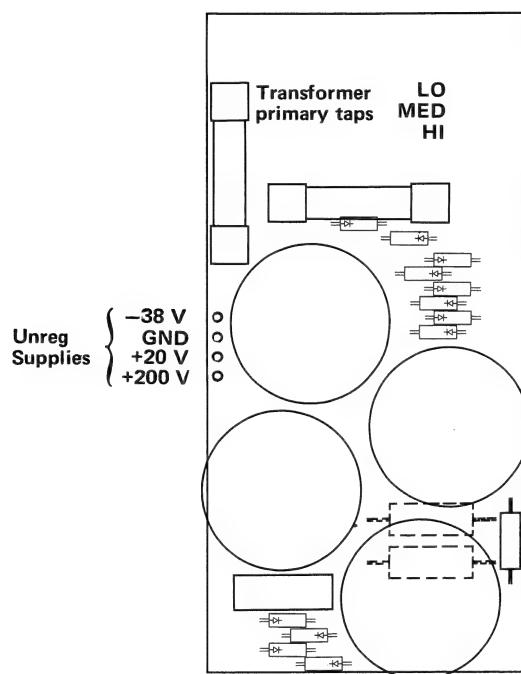


Fig. 4-10. Transformer primary taps and power supply test points.

MECHANICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS

BHB	binding head brass	h	height or high	OHB	oval head brass
BHS	binding head steel	hex.	hexagonal	OHS	oval head steel
CRT	cathode-ray tube	HHB	hex head brass	PHB	pan head brass
csk	countersunk	HHS	hex head steel	PHS	pan head steel
DE	double end	HSB	hex socket brass	RHS	round head steel
FHB	flat head brass	HSS	hex socket steel	SE	single end
FHS	flat head steel	ID	inside diameter	THB	truss head brass
Fil HB	fillister head brass	lg	length or long	THS	truss head steel
Fil HS	fillister head steel	OD	outside diameter	w	wide or width

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Q					Description		
				t	y	1	2	3	4	5	
1-1	390-0270-00			1		CABINET SIDE, right					
	390-0244-00			1		CABINET SIDE, left					
	- - - - -			-		each cabinet side includes:					
	214-0812-00			2		LATCH ASSEMBLY					
	- - - - -			-		each latch assembly includes:					
-2	386-0226-00			1		PLATE, locking					
-3	386-0227-00			1		PLATE, index					
-4	214-0604-00			1		SPRING, latch					
-5	214-0603-01			1		PIN, securing					
-6	390-U280-00			1		CABINET BOTTOM					
	- - - - -			-		cabinet bottom includes:					
	214-0812-00			4		LATCH ASSEMBLY					
	- - - - -			-		each latch assembly includes:					
-7	386-0226-00			1		PLATE, locking					
-8	386-0227-00			1		PLATE, index					
-9	214-0604-00			1		SPRING, latch					
-10	214-0603-01			1		PIN, securing					
-11	348-0074-00			2		FOOT, bail limiting, right front and left rear					
	- - - - -			-		mounting hardware for each: (not included w/foot)					
-12	211-0532-00			2		SCREW, 6-32 x 0.75 inch, Fil HS					
-13	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch					
	- - - - -										
-14	348-0207-00			2		FOOT, cabinet, right front and left rear					
-15	348-0073-00			2		FOOT, bail limiting, left front and right rear					
	- - - - -			-		mounting hardware for each: (not included w/foot)					
	211-0532-00			2		SCREW, 6-32 x 0.75 inch, Fil HS					
-16	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch					
	- - - - -										
-17	348-0208-00			2		FOOT, cabinet, left front and right rear					
-18	200-0728-00			2		COVER, handle end					
-19	367-0116-00			1		HANDLE, carrying					
	- - - - -			-		mounting hardware: (not included w/handle)					
-20	212-0597-00			4		SCREW, shouldered, 10-32 x 0.355 inch					
-21	386-1624-00			2		PLATE, retaining					
-22	386-1283-00			2		PLATE, handle mounting, plastic					
	- - - - -										
-23	348-0275-00			1		FLIPSTAND					
-24	200-1218-00			1		BEZEL					
	- - - - -			-		bezel includes:					
-25	211-0188-00			2		SCREW, 4-40 x 0.70 inch					
-26	354-0223-00			2		RING, retaining					

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Q t y	Description
1-27	337-1440-01 ¹			1	SHIELD, implosion, w/graticule
	337-1440-00 ²			1	SHIELD, implosion
-28	386-1946-00			1	SUPPORT, CRT, front
-29	384-1128-00			1	SHAFT, extension, power switch
-30	358-0216-00			1	BUSHING, 0.257 ID x 0.412 inch OD
-31	376-0127-00			1	COUPLER, shaft, plastic
-32	385-0033-00			1	ROD, plastic, 6-32 x 0.625 inch long
	-----			-	mounting hardware: (not included w/rod)
-33	211-0538-00			1	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-34	260-1222-00			1	SWITCH, push-pull--POWER
-35	407-0895-00			1	BRACKET, push switch
	-----			-	mounting hardware: (not included w/bracket)
-36	211-0101-00			2	SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-37	210-0586-00			2	NUT, keps, 4-40 x 0.25 inch
-38	200-1282-00			1	DOOR, access
-39	333-1514-00			1	PANEL, front, upper
	-----			-	mounting hardware: (not included w/pnl)
-40	210-0406-00			3	NUT, hex., x 4-40 x 0.188 inch
	210-0004-00			3	WASHER, lock, internal, 0.12 ID, 0.26 inch OD
-41	366-1023-01 ¹			1	KNOB, gray--STORED BRIGHTNESS
	-----			-	knob includes
	213-0153-00			1	SETSCREW, 5-40 x 0.125 inch, HSS
-42	366-1257-84 ¹			1	PUSHBUTTON--ERASE
	366-1257-85 ¹			1	PUSHBUTTON--STORE
-43	426-0681-00 ¹			2	FRAME, pushbutton
-44	-----			1	RESISTOR, variable
	-----			-	mounting hardware: (not included w/resistor)
-45	210-0583-00			1	NUT, hex., 0.25-32 x 0.312 inch
	210-0940-00			1	WASHER, flat, 0.25 ID x 0.375 inch OD
-46	210-0046-00			1	WASHER, lock, internal, 0.261 ID x 0.40 inch OD
-47	333-1511-00 ¹			1	PANEL, front, lower
-48	333-1512-00 ²			1	PANEL, front, lower
-49	386-2067-00			1	SUBPANEL, front
-50	334-1379-00			1	LABLE, CRT, 0.75 x 1.75 inches
-51	348-0279-00			2	PAD, cushioning, CRT
-52	348-0145-00			2	GROMMET, plastic, U-shape, 1 inch
-53	348-0070-01			3	CUSHION, CRT, 0.69 x 2.03 inches long
-54	337-1419-00			1	SHEILD, CRT, front
	-----			-	mounting hardware: (not included w/shield)
-55	211-0587-00			1	SCREW, 6-32 x 0.188 inch, HHS

¹603 only.²604 only.

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Disc	Q t y	Description					
				1	2	3	4	5	
1-56	344-0226-00 ¹		1	CLIP, cable, for 8 wire ribbon					
-57	337-1535-00		1	SHEILD, CRT, rear					
-58	354-0409-00		1	RING, clamp, CRT sheild					
	- - - - -		-	mounting hardware: (not included w/ring)					
-59	211-0632-00		1	SCREW, 6-32 x 2.25 inches, Fil HS					
-60	343-0123-01		2	CLAMP, CRT retainer					
-61	220-0444-00		1	NUT, square, 6-32 x 0.25 inch					
-62	211-0507-00		2	SCREW, 6-32 x 0.312 inch, PHS					
-63	407-0922-00		1	BRACKET, CRT clamp					
-64	161-0033-11		1	CABLE ASSEMBLY, power, w/terminal					
-65	200-1004-00		1	CABLE NIPPLE, 1.30 inches long					
-66	358-0366-00		1	BUSHING, strain relief, bottom					
	358-0365-00		1	BUSHING, strain relief, top					
-67	352-0076-00		1	FUSEHOLDER, w/hardware					
	- - - - -		-	mounting hardware: (not included w/fuseholder)					
-68	210-0873-00		1	WASHER, rubber, 0.50 ID x 0.688 inch OD					
-69	200-1308-00		1	COVER, CRT, rear					
	- - - - -		-	mounting hardware: (not included w/cover)					
-70	211-0097-00		5	SCREW, 4-40 x 0.312 inch, PHS					
-71	210-0201-00		2	LUG, solder, SE #4					
	- - - - -		-	mounting hardware for each: (not included w/lug)					
-72	211-0007-00		1	SCREW, 4-40 x 0.188 inch, PHS					
-73	200-0616-01		1	COVER, CRT socket					
-74	136-0485-00		1	WIRING HARNESS, CRT					
	- - - - -		-	wiring harness includes:					
-75	136-0304-01		1	SOCKET, CRT, w/connectors					
-76	346-0045-00		3	STRAP, connector cover					
-77	200-0991-00		3	COVER, connector, BNC, w/center ground					
-78	131-0955-00		6	CONNECTOR, receptacle, female, BNC, w/hardware					
	- - - - -		-	mounting hardware for each: (not included w/connector)					
-79	210-0255-00		1	LUG, solder, 0.375 inch, SE					
-80	342-0117-00		2	INSULATOR, bushing, BNC					
-81	- - - - -		1	RESISTOR, variable					
	- - - - -		-	mounting hardware: (not included w/resistor)					
-82	210-0583-00		1	NUT, hex., 0.25-32 x 0.312 inch					
-83	210-0940-00		1	WASHER, flat, 0.25 ID x 0.375 inch OD					
	210-0046-00		1	WASHER, lock, internal, 0.261 ID x 0.40 inch OD					
-84	333-1515-00 ¹ 333-1534-00 ²		1	PANEL, rear					
			1	PANEL, rear					

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Q t y	1 2 3 4 5	Description
1-85	- - - - -			1	TRANSFORMER
	- - - - -			-	mounting hardware: (not included w/transformer)
-86	212-0099-00			4	SCREW, 8-32 x 0.50 inch, HHS
-87	343-0267-00			2	HOLD-DOWN, bracket
-88	210-0458-00			4	NUT, keps, 8-32 x 0.344 inch
-89	342-0028-00			4	INSULATOR, plate, transformer
-90	210-0201-00			1	LUG, solder, SE #4
	- - - - -			-	mounting hardware: (not included w/lug)
-91	210-0586-00			1	NUT, keps, 4-40 x 0.25 inch
-92	131-0569-00			1	CONNECTOR, receptacle, 25 pin
	- - - - -			-	mounting hardware: (not included w/connector)
-93	211-0101-00			2	SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-94	210-0406-00			2	NUT, hex., 4-40 x 0.188 inch
-95	210-0004-00			2	WASHER, lock, internal, 0.12 ID x 0.26 inch OD
-96	337-1541-00			1	SHIELD, high voltage
	- - - - -			-	mounting hardware: (not included w/shield)
-97	211-0008-00			2	SCREW, 4-40 x 0.25 inch, PHS
-98	670-1816-00 ¹			1	CIRCUIT BOARD ASSEMBLY--CONTROL A4
	- - - - -			-	circuit board assembly includes:
	388-2381-00			1	CIRCUIT BOARD
-99	131-0608-00			7	TERMINAL, pin, 0.365 inch long
-100	200-1327-00			1	COVER, variable resistor
-101	384-1121-00			2	SHAFT, extension, 1.41 inches long
-102	175-0826-00			ft	WIRE, electrical, 3 wire ribbon, 20.50 inches long
-103	175-0829-00			ft	WIRE, electrical, 6 wire ribbon, 24 inches long
-104	- - - - -			4	RESISTOR, variable
	- - - - -			-	mounting hardware: (not included w/circuit board assembly)
-105	211-0008-00			4	SCREW, 4-40 x 0.25 inch, PHS
-106	670-1815-00 ²			1	CIRCUIT BOARD ASSEMBLY--STORAGE & CONTROL A4
	- - - - -			-	circuit board assembly includes:
	388-2380-00			1	CIRCUIT BOARD
-107	131-0608-00			29	TERMINAL, pin, 0.365 inch long
-108	136-0252-04			6	SOCKET, pin connector
	136-0269-00			1	SOCKET, integrated circuit, 14 pin
-109	214-0579-00			3	PIN, test point
-110	200-1327-00			1	COVER, variable resistor
-111	- - - - -			4	RESISTOR, variable
-112	384-1121-00			2	SHAFT, extension, 1.41 inches long
-113	260-1308-00			1	SWITCH, push--ERASE
-114	384-1061-00			1	SHAFT, extension, 3.981 inches long
-115	260-1211-00			1	SWITCH, push--STORE
-116	384-1099-00			1	SHAFT, extension, 1.54 inches long

FIG. 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Q t y	1 2 3 4 5	Description
1-117	175-0826-00			ft		WIRE, electrical, 3 wire ribbon, 20.50 inches long
-118	175-0829-00			ft		WIRE, electrical, 6 wire ribbon, 24 inches long
- - - - -				-		mounting hardware: (not included w/circuit board assembly)
-119	211-0008-00			5		SCREW, 4-40 x 0.25 inch, PHS
-120	366-0261-00			4		KNOB, gray, w/spring
-121	670-1813-00			1		CIRCUIT BOARD ASSEMBLY--HIGH VOLTAGE A3
- - - - -				-		circuit board assembly includes:
	388-2378-00			1		CIRCUIT BOARD
-122	131-0608-00			6		TERMINAL, pin, 0.365 inch long
-123	214-0579-00			4		PIN, test point
-124	175-0827-00			ft		WIRE, electrical, 4 wire ribbon, 18 inches long
- - - - -				-		mounting hardware: (not included w/circuit board assembly)
-125	211-0008-00			1		SCREW, 4-40 x 0.25 inch, PHS
-126	670-1814-00 ¹ 670-1859-00 ²			1		CIRCUIT BOARD ASSEMBLY--RECTIFIER A5
- - - - -				1		CIRCUIT BOARD ASSEMBLY--RECTIFIER A5
	388-2379-00			-		circuit board assemblies include:
-127	131-0608-00			1		CIRCUIT BOARD
-128	131-0707-00			14		TERMINAL, pin, 0.365 inch long
-129	200-0256-00			6		CONNECTOR, terminal
-130	200-0257-00 ¹ 200-0532-00 ¹			1		COVER, capacitor, 1.0 inch diameter x 2.031 inches long
-131	344-0154-00			1		COVER, capacitor, 1.0 inch diameter x 2.531 inches long
-132	352-0166-01			1		COVER, capacitor, 0.99 ID x 1.594 inches long
	352-0166-02 ²			4		CLIP, electrical, fuse
-133	175-0827-00 ¹			1		HOLDER, terminal connector, 8 wire (brown)
-134	175-0830-00			1		HOLDER, terminal connector, 8 wire (red)
- - - - -				ft		WIRE, electrical, 4 wire ribbon, 9 inches long
-135	211-0008-00			ft		WIRE, electrical, 7 wire ribbon, 3 inches long
- - - - -				-		mounting hardware: (not included w/circuit board assemblies)
				2		SCREW, 4-40 x 0.25 inch, PHS
-136	670-1812-00			1		CIRCUIT BOARD ASSEMBLY--Z AXIS A2
- - - - -				-		circuit board assembly includes:
	388-2377-00			1		CIRCUIT BOARD
-137	131-1003-00			2		RECEPTACLE, coaxial cable
-138	136-0252-04			8		SOCKET, pin connector
-139	214-0579-00			8		PIN, test point
-140	214-1254-00			2		HEATSINK, transistor
-141	337-1179-00			1		SHIELD, electrical
- - - - -				-		mounting hardware: (not included w/circuit board assembly)
-142	211-0008-00			2		SCREW, 4-40 x 0.25 inch, PHS

¹603 only²604 only

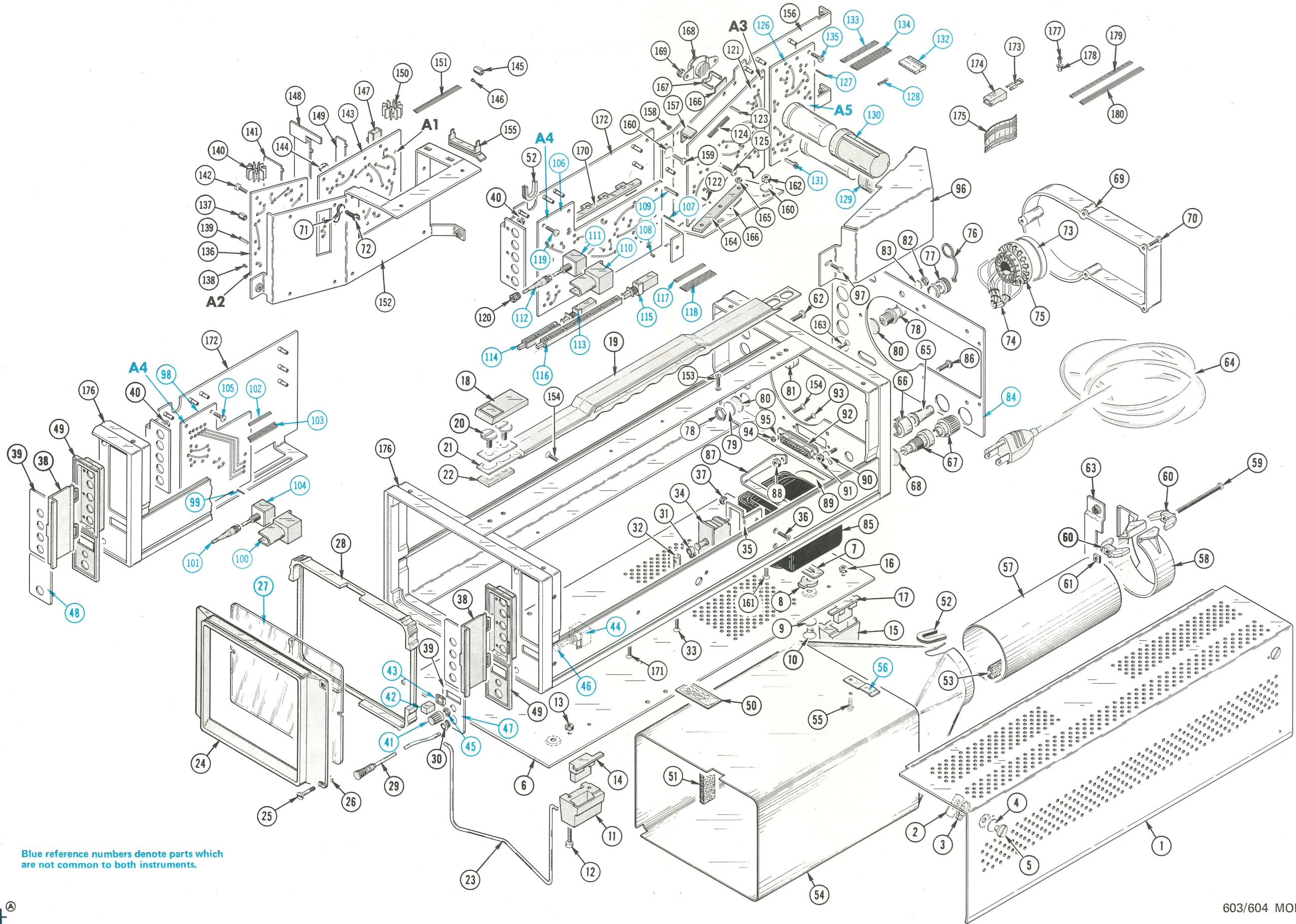
FIG. 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q					Description	
				t	y	1	2	3	4	5
1-143	670-1811-00			1	CIRCUIT BOARD ASSEMBLY--DEFLECTION A1					
	- - - - -			-	circuit board assembly includes:					
	388-2376-00			1	CIRCUIT BOARD					
-144	131-0566-00			4	LINK, terminal connector					
-145	131-1003-00			4	RECEPTACLE, coaxial cable					
-146	136-0252-04			16	SOCKET, pin connector					
-147	260-0723-00			5	SWITCH, slide					
-148	337-1626-00			1	SHIELD, electrical, front					
-149	337-1627-00			1	SHIELD, electrical, rear					
-150	214-1291-00			4	HEATSINK, transistor					
-151	175-0827-00			ft	WIRE, electrical, 4 wire ribbon, 6.50 inches long					
	- - - - -			-	mounting hardware: (not included w/circuit board assembly)					
	211-0008-00			2	SCREW, 4-40 x 0.25 inch, PHS					
-152	441-1041-00			1	CHASSIS, deflection					
	- - - - -			-	chassis includes:					
	344-0133-00			4	CLIP, circuit board					
	210-0659-01			4	EYELET, 0.121 OD x 0.156 inch long					
-153	211-0025-00			-	mounting hardware: (not included w/chassis)					
-154	211-0101-00			2	SCREW, 4-40 x 0.375 inch, 100° csk, FHS					
				3	SCREW, 4-40 x 0.25 inch, 100° csk, FHS					
-155	344-0225-00			1	CLIP, cable, for 4 wire ribbon					
-156	441-1042-00			1	CHASSIS, power supply					
	- - - - -			-	chassis includes:					
-157	344-0133-00			5	CLIP, circuit board					
-158	210-0659-01			5	EYELET, 0.121 OD x 0.156 inch long					
	- - - - -			-	mounting hardware: (not included w/chassis)					
-159	211-0541-00			2	SCREW, 6-32 x 0.25 inch, 100° csk, FHS					
-160	210-0949-00			4	WASHER, flat, 0.141 ID x 0.50 inch OD					
-161	211-0538-00			2	SCREW, 6-32 x 0.312 inch, 100° csk, FHS					
-162	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch					
-163	211-0101-00			3	SCREW, 4-40 x 0.25 inch, 100° csk, FHS					
-164	343-0315-00			1	CLAMP, transistor					
	- - - - -			-	mounting hardware: (not included w/clamp)					
-165	210-0407-00			3	NUT, hex., 6-32 x 0.25 inch					
-166	342-0082-00			9	INSULATOR, plate, 0.52 inch square					
-167	344-0236-00			2	CLIP, spring tension					
-168	- - - - -			1	SWITCH, thermostatic					
	- - - - -			-	mounting hardware: (not included w/switch)					
-169	210-0586-00			2	NUT, keps, 4-40 x 0.25 inch					

FIG. 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Q	t	y	1	2	3	4	5	Description
1-170	343-0337-00			1	CLAMP, transistor							
	- - - - -			-	mounting hardware: (not included w/clamp)							
-171	211-0538-00			4	SCREW, 6-32 x 0.312 inch, 100° csk, FHS							
-172	441-1043-00			1	CHASSIS, storage and control							
-173	131-0861-00			3	TERMINAL, quick disconnect							
-174	200-1075-00			4	COVER, terminal							
-175	195-0102-00			1	LEAD-SET, CRT deflection							
-176	426-0841-00			1	FRAME ASSEMBLY							
-177	210-0775-00			6	EYELET, 0.125 OD x 0.145 inch long							
-178	210-0774-00			6	EYELET, 0.152 OD x 0.245 inch long							
-179	175-0826-00			ft	WIRE, electrical, 3 wire ribbon, 5 inches long							
-180	175-0827-00			ft	WIRE, electrical, 4 wire ribbon, 17 inches long							

FIG. 1 EXPLODED



**FIG. 2 STANDARD ACCESSORIES &
REPACKAGING**

STANDARD ACCESSORIES

Fig. & Index No.	Tektronix Part No.	Serial/Model No.	Eff	Disc	Q t y	1 2 3 4 5	Description	
							1	MANUAL, instruction (not shown)
2-	070-1259-00							

**CARTON ASSEMBLY
(Part No. 065-0150-00)**

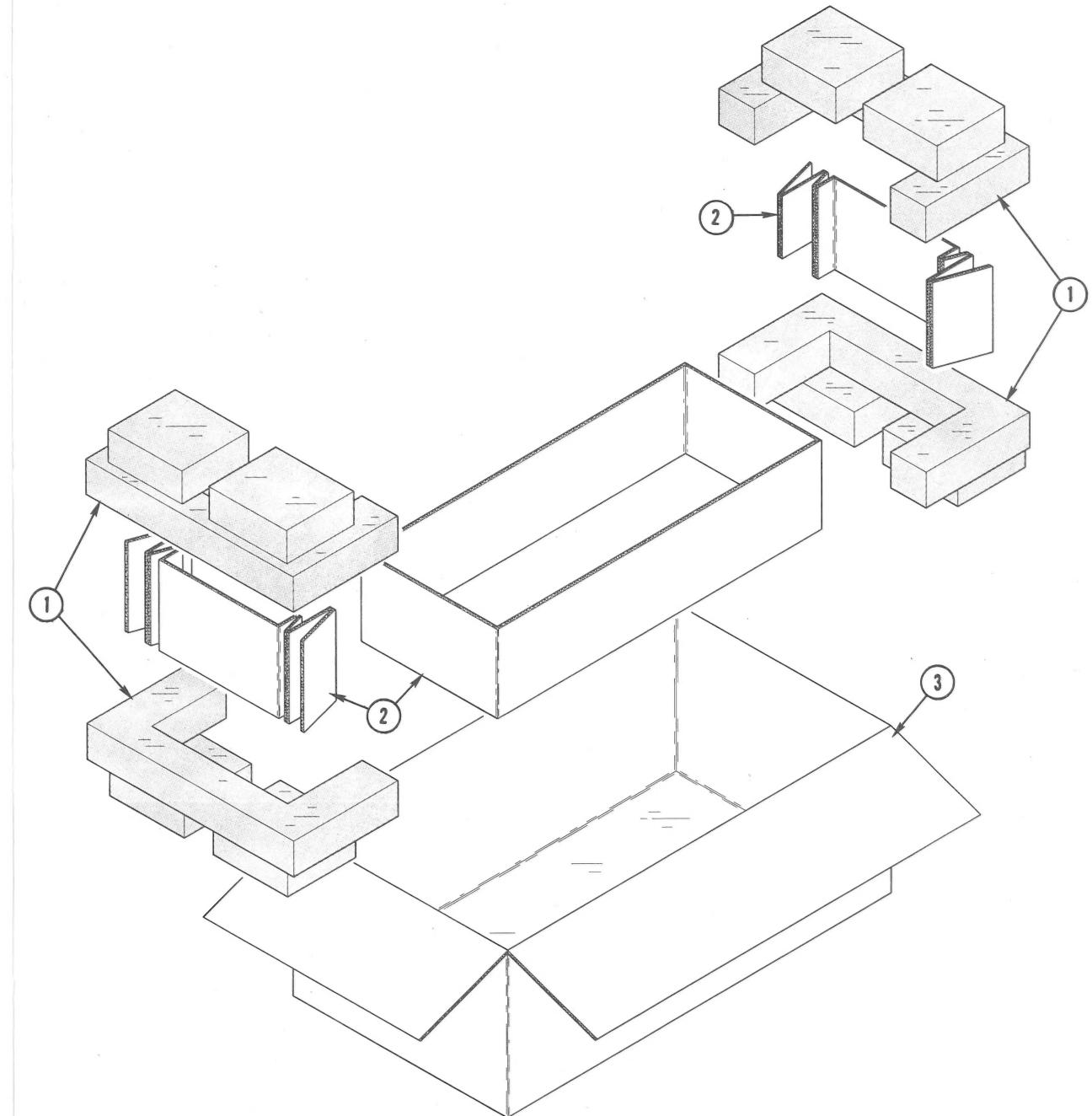


Fig. & Index No.	Tektronix Part No.	Serial/Model No.	Eff	Disc	Q t y	1 2 3 4 5	Description				
							1	2	3	4	5
2-	065-0150-00						1	CARTON ASSEMBLY			
							-	carton assembly includes:			
-1	004-0281-00						2	ETHAFRAME, top & bottom			
-2	004-1097-00						1	PAD SET, 3 piece			
-3	004-0791-00						1	CARTON			